The
Electrical Review

VOL. CXXIV. MARCH 31, 1939. No. 3201.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Waterloo 3333 (50 lines).

The "Electrical Review" is the recognised medium of the electrical trades and has by far the largest circulation of any electrical industrial paper in Great Britain. SUBSCRIPTION RATES, Postage free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Classified Advertisements—Supp. 17.
Index to Advertisers—Page xl.

The Two Paths

Steam Pressures and Temperatures

SIGNS are not wanting that the steam conditions of a little over 600 lb. per sq. in. and 800 deg. F. that are now regarded as more or less standard for new public supply generating stations represent a stage of development that is drawing to its close. Boilers designed for upwards of 1,200 lb. per sq. in. have recently been put in commission or are projected and there seems every reason to suppose that the practice, which has been found desirable in the United States for interconnected working, will be found suitable for grid operation in this country also.

Such a tendency will no doubt be accelerated by the call to keep fuel costs down in face of the rising price of coal, with a view to securing the immense business that can be obtained from high load-factor consumers only if running charges are low enough.

By raising steam conditions from the 600-lb.-800-deg. region to, say, 1,200 lb. per sq. in. and 970 deg. F., an increase in thermal efficiency of nearly 12 per cent. can be obtained. The overall benefits to be derived from increasing the temperature are, however, appreciably greater than those due to the use of higher pressures.

There is another aspect of the temperature question and that is the need to avoid blade erosion due to excessive wetness of steam at the turbine exhaust. Land practice in this country is to fix the maximum wetness fraction at 13 to 14 per cent. (marine engineers favour a much lower figure) and in order to fulfil this condition the temperature must be in a definite relationship to the pressure; *e.g.*, 600 lb. per sq. in. requires 800 deg. and 1,200 lb. requires 970 deg. to keep the fraction down to 13 per cent.

Expensive Alloys

High pressures involve little difficulty in construction nowadays, but temperatures above those in common use necessitate the use of expensive steel alloys. For the Battersea B station boiler steam conditions of 1,420 lb. per sq. in. and 965 deg. F. have been decided on. When the order was placed, no superheater metal capable of withstanding so high a temperature had yet been made, but difficulties in this connection have since been overcome, we were informed during a recent visit to the research laboratories of Babcock & Wilcox which, with the reconstructed foundries at Renfrew, are described in this issue.

The intention, then, at Battersea B is to force the initial temperature up to as high a point as the present state of metallurgy permits, but the pressure adopted is the maximum to secure the requisite dryness of steam, and for higher pressures a different method is required. At the Brimsdown A station, for instance, where the pressure is 1,900 lb. per sq. in., the temperature is 930 deg., and the steam, after expansion to 200 lb., is reheated to 820 deg. before passing to the low-pressure turbine of the set.

Reheating, (first developed on the North-East Coast) is common practice in the United States, as Sir Leonard Pearce points out in his valuable review of progress of power stations and their equipment in the last issue of the I.E.E. *Journal*. It is employed at Port Washington station (thermally the most efficient steam station in the world) where the initial steam conditions are 1,230 lb. and 825 deg. He detects, nevertheless, a tendency towards a return to the use of higher initial temperatures instead of reheating and points out that the reheat cycle is suitable only for base-load stations.

Reheating Considerations

While a gain in thermal efficiency of some 5 per cent. should be obtained through reheating with similar steam conditions (Dunston B has smaller sets than its nearest 625-lb. competitors), this is lost at high pressures since the initial temperature is not relatively increased. In his presidential address to the Association of Supervising Electrical Engineers, Mr. J. R. Beard suggested that for pressures above 1,100 lb. per sq. in. the reheat cycle with temperatures for which ordinary steels are suitable possessed many attractions and would obviate the use of expensive alloy steels. This must, of course, be set off against the by no means negligible cost of reheating equipment.

For base-load stations operating with boiler pressures up to 1,400 lb. per sq. in. the question is essentially which method provides for the wetness factor at the least overall cost. We should hesitate to set limits to what metallurgical research can give us in this way—at a cost—but at the moment there is not enough evidence concerning capital costs, maintenance and operating features to decide which of the two methods is likely to possess the greater advantages in practice.

Electricity Charges

STANDARD "universal" tariffs are the ideal of a good many people in the electrical industry. There is much to be said for them and, we suppose, the general tendency of tariff policy in this country is towards this goal. The paper by Messrs. J. W. Beauchamp and R. Kaufmann presented at yesterday's meeting of the I.E.E. showed how this policy was being pursued in Germany and France. A noteworthy feature of the German arrangements is the encouragement of rural consumption with differentiation between agricultural and household usage. A measure of standardisation of apparatus accompanies the tariff decree. France favours a multi-part rather than a two-part tariff and standardisation of charges in the departments (equivalent to counties) is being achieved. The authors do not favour the inclusive (or "water-rate" type) of charge for Great Britain but consider that a "kW-year" method of charging might be possible.

Lighting Progress

THE "good old days" were, roughly speaking, the days when it might take anything up to half-an-hour to obtain a light, even if the tinder was dry. A corrective to any regrets for the less hectic conditions of a past age will be found in the Science Museum, South Kensington, where an extension by 3,000 sq. ft. of the space allocated to the illumination section will be opened to-morrow. A permanent feature is to be the Bryant and May collection of fire-making appliances from the earliest days, said to be the most complete in the world. The historical display of illuminants up to the most recent electric lamps (including one of the arc lamps used in the pioneer scheme outside the Royal Exchange in 1881) will be supplemented by demonstrations of the principles of good lighting and its use in decoration. In this, at all events, there is surely much to confute pessimism as to the effects of scientific progress on the good of the race.

Disposal of Profits

MOST of our leading electrical manufacturers did well during the past year and were able to show a satisfactory expansion of profits. Some increased their dividends, and the shareholders of those who did not may wonder why. As a rule, there is no reason at all why ordinary shareholders should not benefit by their company's prosperity, but present uncertainties enforce the conservation of resources. Quite apart from this, however, it should be the practice, when times are good, to pay more attention and devote more funds to research. Customers look for the latest and best, and the concern which has strengthened its research organisation during a prosperous period is in the best position to meet the intensified competition experienced when general prosperity declines. Money spent on research is a good business investment as well as a national service.

The Domestic Demand

To us the main interest of the P.E.P. report on the gas industry, reviewed on page 466, lies in the points of contact with the electrical industry rather than in the proposals for future control and policy. Without stopping to argue about the utilisation efficiency figures given for gas and electricity we may say that they are "gas" figures and are open to question. Among the principal points in the report are the relative positions of gas and electricity in the home. While gas output is consumed to the extent of 60 or 70 per cent. by domestic consumers, the corresponding figure for electricity is given as 25 per cent. Again, electricity is said to provide only 2½ per cent. of the "useful heat" used domestically, against 18½ per cent. by gas and 52½ per cent. by coal. If these figures show anything they indicate a vast field for the sale of electricity and should encourage electricity supplies to go ahead with their domestic campaigns.

Poor Propaganda

IN other days we sometimes had to admire the sales and publicity methods of the gas industry and even held them up as an example occasionally. The P.E.P. Committee, however, says that these methods are among the weaknesses of the industry. Can it be that we have outstripped them? It is not actually said, but it might be inferred from the report that this was the case. Let us not be complacent, however; there are still many places in which electrical propaganda is weak or lacking. Before leaving the gas industry we must quote a remark by a speaker at a recent gas conference: "Black cookers should be ousted as far as possible; there is no black electric cooker." There may be survivors, but the electrical industry has certainly shown gas the way in this connection.

IN THIS ISSUE

	Page
Articles:	
High-grade Castings ..	451
Metering Equipments ..	454
Motor Developments ..	455
Symmetrical Components	456
Switches and Sockets ..	457
Contact Metals	459
Here and There	462
Instalment Sales	467
News:	
Bulk Supply and Peak Loads	453
"Nesco" Jubilee ..	460
Electricity Tariffs: I.E.E. Paper	461
P.E.P. Report on Gas Industry	466

The North-East Coast

ONE hesitates to use the overworked word "unique" about anything. Nevertheless, it can surely be applied in its literal sense to the supply undertaking on the North-East Coast which was started half a century ago to become the precursor of modern methods of large-scale generation, transmission and load building. Its early work was carried out unobtrusively, so that it is news to some electrical engineers to-day that the technique of many leading engineering developments in all countries had its orgin there. Much as the world is in debt to this British achievement, however, it owes as much to the men who went off to take up positions of responsibility in all quarters of the globe. Neither is that the whole of the story, as the strength of the personal link of their former work together is clearly a very real one. We say "their work," because it is not a matter of mere geographical association, since they were drawn from all parts of the country. The golf competition last week between past and present members of the staff was won by the latter—a good omen that the traditions established will be at least maintained.

Not Consulted

THE fact that the Hampton swimming bath of the Twickenham Corporation is to be floodlighted by gas is in itself not of great importance, for electricity has little to fear from gas in the lighting field. The circumstances which were disclosed to the London and Home Counties J.E.A. (the supply authority) at its meeting last week, however, reveal a lack of liaison which should be guarded against. The Authority was not consulted, and although the cost of installing electrical floodlighting was less than in the case of gas, the maintenance charges were more because they were based on the ordinary lighting flat rate, whereas the gas company which submitted the successful tender would naturally have given a more competitive price.

HIGH-GRADE CASTINGS

Production in a Reconstructed Scottish Foundry

A COMPLETE reconstruction of the steel foundry of Babcock and Wilcox, Ltd., at Renfrew, where castings have been produced for more than twenty years, has recently been completed. The building now comprises two bays 330 by 75 ft. and 175 by 35 ft. At present 110 men are employed in producing annually about 1,000 tons of carbon-steel and 150 tons of alloy-steel finished castings usually weighing up to 20 cwt. apiece, although heavier work is also undertaken.

General view from the furnace platform of the reconstructed steel foundry of Babcock and Wilcox, Ltd., at Renfrew

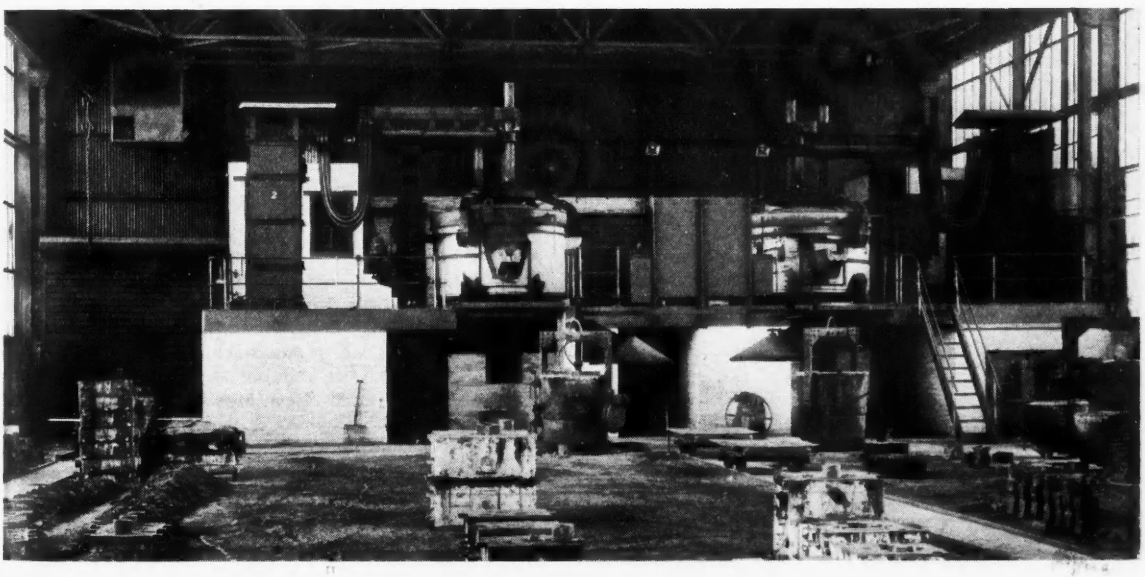
Notable among the special steels is the chromium-nickel-aluminium alloy known as "Calmet," which has been developed to retain strength and to resist oxidisation under the action of hot gases or temperatures up to 1,920 deg. F., and attack by gases containing sulphur compounds and also to obviate embrittlement in service. Its applications include boiler furnace components, superheater supports and griller plates for electric cookers.

Castings for valves, pipe-work and other purposes are produced here and the foundry is equipped with B. & W. cranes for duties of 10, 5 and 2 tons and also five 30-cwt. hydraulic jib cranes.

Melting is carried out in three Heroult arc furnaces, incorporating automatic electrode control. Two of these, by Siemens-Schuckert, melt a three-ton heat of steel in 2½ hours and the third, by the Electric Furnace Co., Ltd., deals with a 15 cwt. heat of alloy steel in 2 hours. The great advantage experienced with the arc furnace is that a very high temperature can be obtained and that conditions can be made oxidising, neutral or reducing, as required. The high temperature is produced above the slags which keeps them active, and gives a fluid steel. Chemical reactions are mainly determined by the slags, the furnace atmosphere being practically without effect.

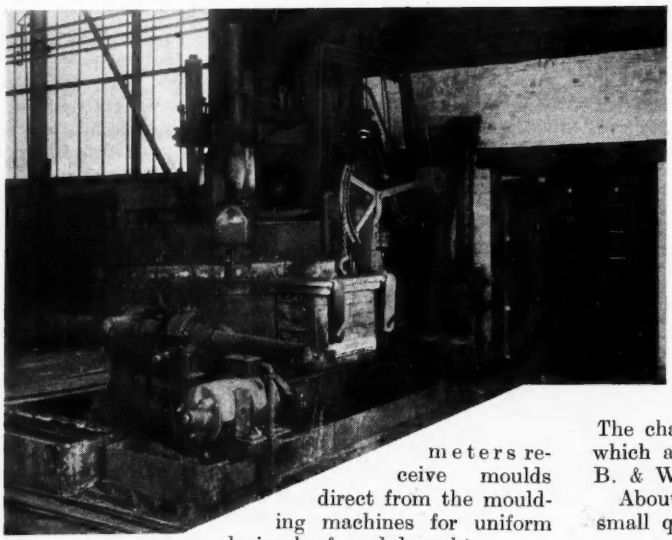
All the furnaces at Renfrew are basic-lined. In this type the steel, after being de-gassed, can be held in an unchanged condition under the basic slags for as long as desired, whereas with an acid slag and lining the steel picks up silicon. The basic process is thus preferable with high melting-point alloying materials, which take a definite time to be absorbed, and is, incidentally, being increasingly adopted in this connection in the United States, where the acid method was formerly in vogue. Further, the basic process produces from low grade material a steel that has a very low phosphorus and sulphur content and is largely degassed. Melting procedure is under the supervision of two metallurgists with eight assistants. Records are kept of every addition made to the furnace and of time and temperature throughout each heat.

Both machine and hand moulding in green sand and dry sand are employed. Three Pneulec "Herman" 4,000-lb. jarr ram rollover machines produce from 5 to 20 cwt. of castings and make about fifteen moulds (2 ft. to 4 ft. sq.) per day. For jobbing work of all sizes a Foundry Plant and Machinery Co.'s "Sandslinger" is used. Castings of less than 28 lb. are made in quantity on a Molineux jarr squeeze turnover machine, on which moulds are manhandled before being



Steel melting units and ladle drying burners

taken on a roller track conveyor to a casting station. Heavier castings are made in dry sand. Three mould-drying stoves fitted with Budenberg recording pyro-



meters receive moulds direct from the moulding machines for uniform drying by forced draught.

All cores are made in a section of the smaller bay either by hand or on two Pneulec jarr ram machines. Machine-made cores are conveyed to a continuous drying stove, the others are dried in a forced-draught bogie stove. The synthetic moulding composition used for dry-sand castings is mixed in a 2½-ton per hour "Pneulec" mill. A disintegrator and electric riddle are also used in mixing green sand and Pneulec royer machines for mixing backing sand. Core sand consists of silica sand with oil binders formed in a Fordath "Rotoil" mixer.

After the castings have been stripped of sand and cores, their risers are cut off close to the casting face, a procedure which obviates the risk of local heating attached to gas-cutting and makes a cleaner job for machining. High-pressure sand blasting follows the use of pneumatic chisels and swing and stationary grinders. Heat treatment, varying with the type and composition of the casting to be annealed, is carried out in a furnace opened at either end. While one bogie is in the furnace the other is loaded for the next cycle. A recording pyrometer, of the Foster Instrument Co.'s make, provides a record of the heat treatment given to each charge.

The work of reorganisation at Renfrew has also included the complete rebuilding of the iron foundry, which now consists of four bays 512 ft. long with a total width of 256 ft. The first bay is confined to green-sand moulding and is equipped with two large jarr rollover moulding machines, one "Tractor" sandslinger, a 10-ton and two 5-ton B. & W. electric overhead travelling cranes. Bay No. 2, in which light castings are made, also contains the moulding unit and storage bins for raw materials.

Bay No. 3 is the dry-sand moulding section where the largest castings are made. Its equipment includes a stationary sand-slinger and a jarring machine used in moulding these castings. A continuous casting plant and a battery of sunk track moulding machines is also located there. In the fourth bay, Bailey blocks are moulded, dressed, machined and packed. Alloy-iron casting and melting is also carried out in this section.

Next comes the iron foundry which finds

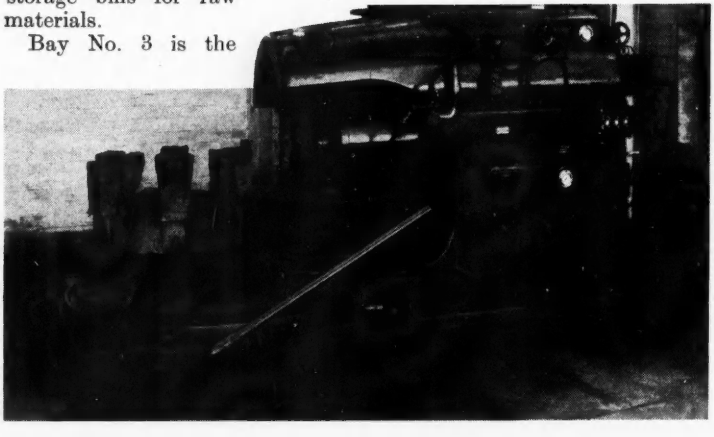
Alloy steel melting unit

work for 140 moulders and produces some 21,000 tons of finished castings per annum, many malleable iron or of special mixture giving wear- and heat-resisting qualities. Five centrally disposed cupolas manufactured by B. & W. to designs of the British Cast Iron Research Association melt 10 tons an hour with an average output of 600 tons per week. The charges are weighed into self-discharging vessels which are deposited into the cupolas by a special B. & W. crane.

About 500 moulds per day (for castings required in small quantities only) are made by hand and about

The core-making department

2,600 by various types of jarr rollover moulding machines, sandslingers and B. & W. hydraulic squeeze machines. The largest casting seen was a base plate for pulverised-coal plant measuring 16 ft. by 6 ft. 6 in. by 1 ft. 6 in., weighing 6 tons. The most notable feature of the iron foundry is probably the Morris continuous casting plant, which, operating on a single shift only, produces up to 6,000 moulds per 8½-hr. day, the total number of castings per day being approximately 30,000, weighing 40 tons. An endless conveyor carries the moulds from the moulding machines to the casting station and from there to the knock-out



Riser cutting saw

and sand-reclaiming plant, the latter reconditioning 240 tons of sand each day. Nine hydraulic squeeze moulding machines, designed by Babcock & Wilcox, serve the plant, which is operated by twenty-seven men and eight youths.

The facing sand for other castings is

prepared by an Augusts sand plant consisting of elevator, storage hopper, silt extractor, screen, magnetic separator and hoist; each mill is also provided with a disintegrator. Its capacity is 5 tons per hr. and working day and night it reconditions 60 tons per double shift.

After being knocked out, the castings are conveyed by rail and motor truck to the dressing shop, where the larger castings are cleaned in a sand-blast cabinet before being taken by overhead cranes to the fitters' benches. Stoker links and small castings are delivered direct from the continuous plant to a Tilghman's "Wheelabrator," which, combining the properties of a rumbler and sand blast, discharges them on to a steel-belt conveyor on which they are sorted before being placed in 10-cwt. bogies for transport to various types of grinding wheels. Nearly 350,000 standard stoker links are kept in stock. Ten tons of malleable castings pass through the dressing shop each week.

A good example of straight-line production is to be found in the core-shop layout, in which twenty-five girls, working within two paths of a roller-track conveyor, turn out about 6,000 cores a day. The continuous drying core stove has a cycle of 2¼ hr. at 450 deg. F. Coleman core and jarr ram machines are installed. Impressive as is the array of up-to-date plant, the most memorable feature is the cleanliness of both steel and iron foundries, contrasting with conditions considered inseparable from such work a few years ago.

Technical Process Control

Technical control over all processes is exercised by a foundry-sand testing laboratory and the research department. The latter is divided into mechanical and chemical sides, the latter including the metallographic and fuel sections. Included in the equipment of the mechanical laboratory are four tensile testing machines with capacities of up to 10 tons, as well as Izod impact, Brinell hardness, Vickers hardness, Avery torsion and fatigue testing machines, the last designed by the Department. There are also three automatically controlled electric furnaces for heat treatment with temperature recorders and a machine shop employing fourteen hands.

For the analysis of non-ferrous metals twelve electrolysis cells electrically controlled in groups of three have been designed by the Department. In the metallographic section, where about 200 micro-specimens are examined and 1,500 photographs are produced each month, Leitz and Reickert microscopes capable of magnifications of 3,000 diameters and 500 diameters are installed. A Leitz macroscope is also employed for taking macro-photographs of sections of welds, flow lines and forgings and other work for which the required magnification does not exceed 20 diameters.

Mechanical Fuel Sampler

Two polishing machines and an electrically heated hydraulic press for setting micro-specimens in bakelite have been made in the Department. Another item designed by the Department is a mechanical fuel sampler consisting essentially of triangular boxes, mounted on a turntable rotating at 60 RPM, into which finely crushed coal falls from a hopper. A fraction of the sample is selected by taking the contents of an appropriate number of boxes. The Mahler-Kroecker high-pressure oxygen bomb calorimeters used are insulated by double-walled boxes from external temperature changes.

A complete installation is available for the fatigue testing of fusion-welded drums and of all kinds of pressure parts, and continuous X-ray investigation is made of the structure of the welds. An experimental boiler with an evaporative capacity of 40,000 lb. per hr. has been constructed for working at a drum pressure of 1,575 lb./sq. in. for studying boiler performance.

For comparing the life of various materials at high steam temperatures, two independently fired superheaters, each consisting of six tubes of different materials, are used. Steam at pressures up to 1,400 lb. per sq. in. is passed through the tubes, the walls of which are raised to temperatures considerably in excess of those found in current practice, and tests are continued until a tube fails.

Bulk Supply and Peak Loads

AMONG the matters that were reported to the meeting of the London and Home Counties Joint Electricity Authority last week was the recent resolution, at a conference of supply authorities, in support of an application by the Epsom and Ewell Corporation to be allowed to use a proportion of its generating plant at times of peak load to reduce the cost of bulk supply.

The J.E.A. communicated with the Central Electricity Board, which opposed any action on the lines indicated. It stated that if authorised undertakings wished to retain their generating stations for the purpose of A.R.P. or for other special emergencies, it would have no objection, but would not contribute towards the cost. It would object to the operation of any such stations except with its concurrence in each case.

In the Board's opinion, upon the termination of the special terms of supply under the agreements between the undertakings concerned and the J.E.A., the undertakings were immediately bound to take the whole of their requirements as an indirect supply from the Board, and the Authority could not legally agree to a variation of those terms. Having regard to the views expressed by the Central Electricity Board, the Authority did not consider that there was any advantage in proceeding further in support of the proposals of the Epsom and Ewell Corporation.

The "Cold Snap"

On the same question of bulk supply, the Technical Committee of the Authority reported that having regard to representations made by several authorised undertakings on the calculation of the maximum demand for 1938, in view of the short period of severe weather in December of that year, the whole question was raised with the Central Electricity Board. A reply was received from the Board stating that, in its opinion, the cold weather did not give rise to any substantial general rise in the demands anticipated at the commencement of the year by the authorised undertakings supplied from the grid, and its effect was very unequal as between individual undertakings.

The Central Board was advised that it had no power to vary the terms of its published tariffs in favour of individual undertakings, and on that ground would therefore be unable to accede to any request for a reduction in grid tariff kilowatt charges. With regard to the bulk supply agreements between the Authority and certain of its constituents, which were complementary to the 1929 agreement between the Board and the Authority, the Board stated that any special arrangement for a reduction of the kilowatt charge would be inequitable having regard to the position of undertakings purchasing their supplies at the grid tariff.

"Windfall" for the C.E.B.

Writing in *The Times* of Tuesday last in reply to a letter by Mr. T. Magnay, M.P., on the subject of the Central Electricity Board's charges for bulk supply to undertakings, Mr. W. Fennell, engineer to the Mid-Cheshire Electricity Supply Co., Ltd., states that due to the December cold "snap" the Board has reaped a rich and practically unearned harvest at the expense of undertakings without their own power stations. It was not correct, he said, that the distribution undertakings would share in the harvest. While purchasing their bulk supplies at the grid tariff, which meant paying for the whole year on the basis of the highest measured maximum demand for any half-hour in the winter, the standing charge of their retail two-part tariffs was almost always based upon some fixed measure of size. Even the special cases quoted by Mr. Magnay of hotels, &c., where agreements were based upon maximum demand, would not produce any substantial profit, since the kilowatt charge was only sufficient to allow for the cost of distribution, in addition to the grid charge. These special consumers would suffer, instead of the distributor, to provide their part of the Central Board's windfall.

High-voltage Conference

THE tenth Conference Internationale des Grands Réseaux Electriques à Haute Tension will take place as usual in Paris from June 29th to July 8th. These meetings take place every two years, and this year 110 reports from twenty countries will be discussed during the nine days of the conference, full information about which is obtainable from the British National Committee, 15, Savoy Street, London, W.C.2.

METERING EQUIPMENTS

Suggestions for Improving their Appearance

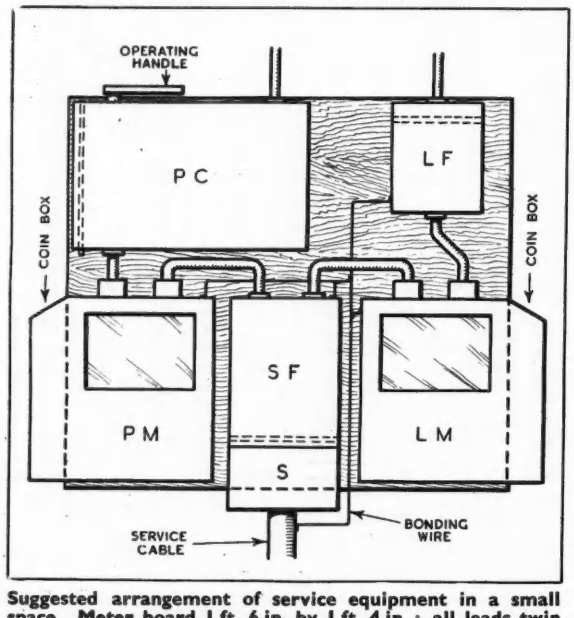
By J. L. Gaved

A RECORD of the position of the meter boards in a hundred houses picked at random in any large town would cover all parts of the normal dwelling from the coal cellar to the front bedroom. In practically every case the consumer's opinion would be that the meter, like the family skeleton, ought to be in a dark cupboard. The meter-reader's opinion of this would certainly be unprintable, although it might draw attention to this unfortunate state of affairs and actuate measures to improve them in future installations.

The inherent trouble lies in the amazing variety of architecture. The meter position must fit the available space in the house, but whether it be in the porch or the front room we might at least endeavour to make it "easy to look at," which it usually is not.

In the same hundred houses we should find a drab arrangement of cut-outs, fuses and bulging meters draped with lead-covered and v.i.r. leads, emerging here and sagging there—a sorry comment on the industry which streamlines a cooker and sinks switches flush with walls.

In the first place, we can eradicate the inconsequent arrangement of the various fittings by deciding upon a proper sequence of connections, fixing the instruments and cut-outs in straight-through consecutive alignment. First would come the supply authority's cut-out and fuses on the end of the board with side outlets for power and lighting leads neatly secured to permit straight and short connection to meters placed adjacent to each other on the board; above the meters



Suggested arrangement of service equipment in a small space. Meter board 1 ft. 6 in. by 1 ft. 4 in.; all leads twin v.i.r.

PC—power cut-out (opens to left); LF—lighting fuses; SF—supply fuses (opening downwards); S—sealing chamber; PM—power meter (plug-in connections); LM—lighting meter (plug-in connections).

the consumers' cut-outs would be fixed on the same board to permit straight upward connections by cleated leads from the meters; finally, the connections to the house circuits would be carried parallel across the top of the board to the point where they either enter conduit tubing or are cleated along the wall.

Meters with Top Entries?

Such an arrangement would bring some order out of chaos, but we have still to distort the connections from the side entries of the authority's cut-out to the bottom entries of the meters, so that obviously top entries here would allow of a neat parallel run of the leads along and above them while the outcoming leads would come straight up to the power and lighting cut-outs. However, meters are not made with top entries nor cut-outs with side entries, but they could be made thus. Moreover, to facilitate removal of meters or cut-outs the whole of the connections could be made by plugged-in connectors provided with locking and sealing devices.

The complete assembly would occupy a board 2 ft. square so that its use would be confined to those houses where the equivalent space was available. It would be compact, however, and neat enough even for the front parlour, without the camouflage of a cloth covering although this is desirable for keeping the dust from the board. There would also be less probability of interference by children in view of the closer grouping of the equipment and the absence of trailing cables, while the safety of the installation would be increased in like manner.

So far there has been no extra cost other than that of socket connections which cannot warrant any significant addition, since a large quantity of standard fittings are concerned which would, moreover, provide greater facility for meter-testing connections.

In Confined Spaces

The question of equipment suitable for installation in positions which will not accommodate this size of board may be answered by pursuing further the endeavour to group the various units more closely. Considering the incoming cut-out or fuse (we are dealing with a single-phase supply and the neutral may or may not be fused also) we desire side outlets for meter leads on the sealing chamber side and bottom entries for the service cable, but if we are to reduce space and place the cut-out cheek to cheek with the first meter we must revert to top entries, since the meter may be on either the right or left of the cut-out. The door of the box should then open downwards preferably, or upwards, but not sideways.

For the second meter we had, in the previous layout, to pass the leads over the top of the first meter. This is unnecessary if we now change the second meter to the other side of the cut-out where it will fit closely without fouling anything. This means that the incoming cut-out occupies the central position on the board flanked on each side by a meter. Both meters and cut-out now have top entries only so that the plug-in connections are the minimum length. An average width for a coin-slot meter is roughly 6 in. and for a cut-out 4 in., hence the maximum width occupied by the group is, say, 1 ft. 6 in., and this is one standard length of meter board.

The consumer's cut-out fuse is fixed over the lighting meter and the power circuit-breaker over the other. The breaker is 1 ft. in depth and consequently requires a considerable elongation of the meter board to accommodate it. Its width, however, is only about 4 in., so that by providing for horizontal action with top and bottom entries we not only obtain straight-up-through connections but likewise save 8 in. of meter board.

The incoming cut-out lid opens downwards and the lids of both breaker and consumer's cut-out should open outwards and upwards respectively, otherwise they would foul the meter casings below them. The lighting cut-out is seldom more than 3½ in. square, so that with its entries also top and bottom it would fit quite comfortably alongside the breaker within the 18 in. width of the board. Grouped in this manner we should be able to utilise a board 18 by 18 in. with ease, and it would look well. With plug-in connections, at least on the meter-end of the leads, we might even imagine a meter-reader without a screwdriver!

Position of the Board

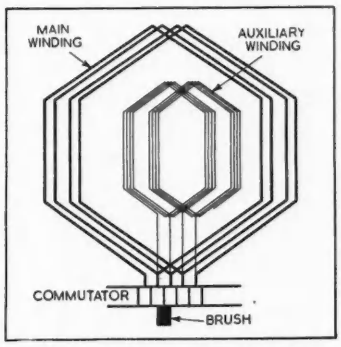
Regarding the position of the meter board in the house, in the majority of cases service connections are made from the front of the house and the sitting-room is the first room. The housewife's problem, among many, is taking the barren spots from a room, the corners being the most difficult, and the occasional table or the aspidistra stand or the wireless set assist materially in this. Would it be so astonishing if a meter cabinet were suggested as a solution to the problem, streamlined if you like?

With a decorative cabinet arranged to accommodate the radio and connected by plug-in connector to the cable-end box sunk flush in the floor or wall we should at one stroke define the standard position of the meters, the cut-outs, the breakers and the rest of it at the least distance from the cable in the pavement. All equipment would be housed under lock and key in ideal conditions and completely camouflaged. It would be secured from interference, and as occasion demanded, as for example if the house were vacated, it could be removed *in toto*. Means of access to the consumer's cut-out only would be provided.

MOTOR DEVELOPMENTS

AC Speed Control, Smaller Starting Currents, Greater Torque

FUNDAMENTALLY, irrespective of precise construction, all polyphase variable speed AC motors operating at a fixed frequency are controlled by adjusting the effective voltage in the rotor circuit. There are several ways of doing this, with more or less complication and practical disabilities of an economic rather than technical character.



Schematic diagram of rotor winding of type " NS " motor

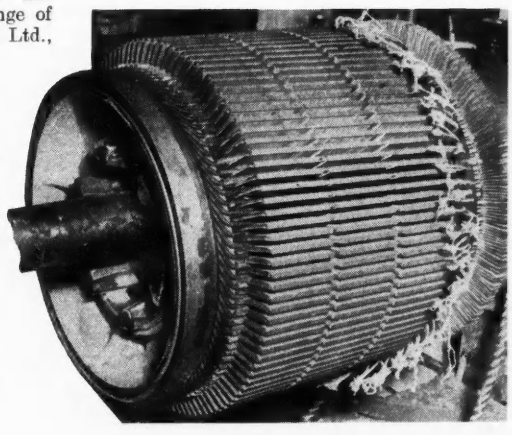
One of the oldest attempts utilised an induction regulator, connected on its primary side to the input mains and on its secondary side to the commutator of a normal DC rotor within a stator exactly like that of a three-phase induction motor, to which the input mains were directly connected. By rotating the induction regulator, which need not be alongside the motor, the voltage applied to the commutator was changed somewhat like a variable-ratio transformer, thereby modifying the speed.

AC Commutation

This method of changing speed has lately assumed more prominence by reason of the better commutation that has resulted from the devising of means of suppressing the brush-sparking tendency, which also obviates moving the brush gear.

This improvement has enhanced the merits of the system, relative to other AC commutator motors or DC multi-machine combinations, and widened its field of application. The salient features are that because commutation characteristics can be made as good as those of DC motors, AC commutator machines can be built for much larger outputs per pole than hitherto, with a wider speed range and of relatively small dimensions. Fewer brushes are required; they need not be of an expensive grade and are soft, so prolonging the lives both of the commutator and the brushes. Since the brush gear, once fixed, need never again be moved, it can be mounted rigidly.

A demonstration motor of this type, representative of the range of sizes for which Higgs Motors, Ltd., Birmingham, have secured manufacturing rights, was referred to in the ELECTRICAL REVIEW of February 24th, 1939, page 276. Since then at one of the Norwich factories of Laurence, Scott & Electromotors, Ltd., larger sizes have been inspected in course of manufacture and a talk with the inventor, Dr. Schwarz, revealed that nearly 400 motors of all sizes are now in service or on order In the aggregate they exceed 40,000 HP, many being of several hundred horse power each and several are of 1,000 HP each, operating at from 200 to 6,000 V; speed ranges up to 22 to 1 are possible. Motors designed according to this newly patented principle have been made for the past four years.

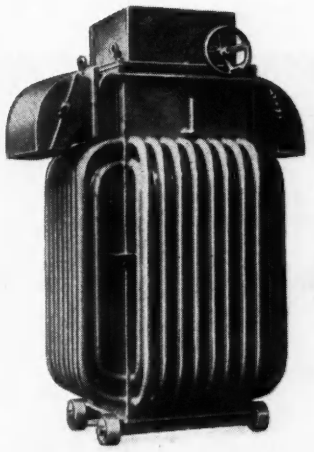


A view of the rotor showing arrangement of windings

Standard induction motor parts are employed, so avoiding additional constructional costs. Commutation is controlled by an auxiliary winding (also of normal DC type) placed at the bottom of the main winding slots in the rotor and connected to the same commutator. Main and auxiliary windings which are in parallel are not in the same slots, and are arranged in such a way as to reduce the reactance of the commutating coils by transformer action. Steel strips (insulated from the main winding) separate the two windings in each slot in order to provide a magnetic circuit for the auxiliary winding. A further difference between the " NS "-type motor and other possibly similar systems is that the voltage between commutator bars is not the maximum for all speeds, but only at standstill and falls to zero at synchronous speed.

The purpose of the auxiliary winding is to suppress sparking at the brushes. Its action may be likened to that of interpoles in DC machines, for in much the same way it overcomes the rapid reversal of current in the coils undergoing commutation. It is in parallel with the spark, offering an alternative path of lower impedance. In addition, it serves by section equalisation to limit the transformer voltage induced in the coils undergoing commutation, due to variation of the primary flux as well as to the presence of higher harmonics of the field.

Furthermore, besides its commutating function, the auxiliary winding also carries load current in inverse proportion to its resistance and consequently does not represent a waste of energy, but is claimed actually to increase the efficiency of the machine. Certainly the three-phase motor of 100 HP continuous rating at 440 V and 50 cycles seen on load test at Norwich was most docile and responsive. Its speed range of three to one was changed as rapidly and repeatedly as the induction regulator could be turned (never more than 180 degrees), and by changing over the connections the process was repeated with equal facility in the reverse direction, a regenerative effect taking place when lowering speed.



Typical arrangement of oil-immersed induction regulator for medium and large " N.S." variable-speed AC commutator motor

Bringing the rotor winding out to a commutator instead of to slip rings ensures that the frequency collected from the brushes is always the same as that of line, whatever the speed, so that the excess energy is capable of being returned to the line, correspondingly increasing the efficiency.

Output Proportional to Speed

Because energy flows from the line through the regulator to the rotor, more power is developed at speeds above synchronism. The output is exactly proportional to speed, a speed range greater than the normal being obtainable by using a slightly larger regulator which can provide regulation down to crawling speed.

Fine voltage graduation ensures smooth speed variation without "steps." The regulator hand wheel is geared to the top of a vertical shaft on which are mounted dual rotors in electrical field opposition, the whole being immersed in oil in a welded tank fitted with self-cooling pipes in transformer fashion. Electro-mechanical interlocks prevent the motor being started unless the regulator is in its lowest speed position, so limiting the starting current drawn by the motor.

The power factor, high at all loads, can be made slightly better at no load than at full and to lead. This desirable characteristic is secured by either or the combination of two methods, with the aid of an extra stator winding. First a slight permanent shift of the brushes from their fixed central position will improve the power factor at all speeds below synchronism, without commutation deterioration, since the auxiliary winding effect is independent of the exact position of the short circuited coil. Secondly, an alternative

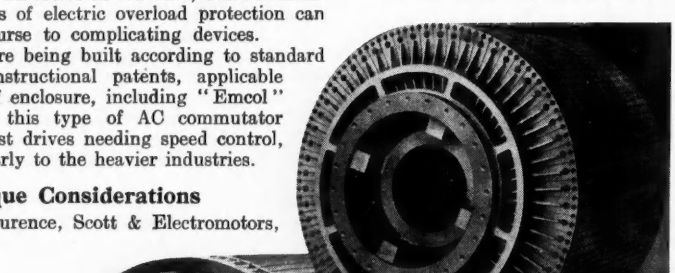
compensating voltage may be injected either by a small external transformer (preferable for extra-high-voltage motors) or by a small exciting winding incorporated in the stator.

An important feature of "NS"-type machines is that, unlike other AC commutator motors, the stator current is proportional to the torque against which they operate and is substantially independent of the speed. This was made evident by the load tests witnessed at Norwich, and its meaning is that normal forms of electric overload protection can be applied without recourse to complicating devices.

Type "NS" motors are being built according to standard L.S.E. welded steel constructional patents, applicable to all the usual forms of enclosure, including "Emcol" total enclosure. While this type of AC commutator motor is suitable for most drives needing speed control, it should appeal particularly to the heavier industries.

Current-torque Considerations

Another product of Laurence, Scott & Electromotors, Ltd., well adapted to withstand heavy duty, is a squirrel-cage motor of original design, its type designation being "low current" high torque. The stator is of standard construction, electrically and mechanically, but the rotor differs essentially from that of any other based on the current displacement starting principle.



Arrangement of slots in low current, high torque rotor and detail of windings.

The core is built up in the normal manner, but has three rows of slots. The upper row, close to the air gap, accommodates a squirrel-cage winding of comparatively high resistance and high thermal capacity.

Each slot of the upper row is connected by a narrow leakage slit alternately to a slot of the second (middle) row, and a slot of the third (innermost) row. Thus the total number of slots in the second and third rows is equal to the total number of slots in the upper (outermost) row. The second and third rows of slots accommodate the main winding, which consists of a number of turns, each turn spanning the second and third rows of slots and connected on one side only to a common short-circuiting ring.

The rotor is very robust and, without sacrifice of full load performance, exerts its greatest torque not only at starting but also throughout the accelerating period. A 75 HP machine on test at Norwich reached its top speed on full load in 1.25 seconds without the least "grunt" of protest.

Such absence of "crawl" is due to the special slot arrangement, the proportioning and distribution of the two rotor windings, and the particular pitch of the main winding. Starting equipment is said to be cheaper, for both star-delta and direct switching, and marked savings in capital and running costs are claimed. High torque motors constructed in accordance with this patented "low current" principle have been made for a number of years. An aggregate of 250,000 HP was made in 1937 alone, more than half representing machines above 50 HP.

The designation "low current" is intended to signify that double torque is obtainable with half the starting current that would otherwise be demanded by an equivalent plain squirrel cage motor, with the sacrifice of perhaps 0.5 per cent. in efficiency and of 1 per cent. in power factor.

Symmetrical Components

Method of Determination

By R. Feinberg

THERE are several geometrical constructions for the determination of the symmetrical components of an unsymmetrical three-phase vector system without residue. In this journal G. W. Stubbings described a very simple construction* which is based on the vector equation

$$A^1=\frac{A}{2}-j\sqrt{\frac{1}{3}}\left(\frac{A}{2}+C\right)$$

with $j=\sqrt{-1}$, and A' representing the positive sequence component of the vector A of the unsymmetrical three-phase vector system A, B and C.

The following deals with a similar geometrical construction, but based on the principle that a given unsymmetrical three-phase vector system may be separated in a symmetrical three-phase system and a two-phase system. Fig. 1 shows the unsymmetrical three-phase vector system ABC, and the symmetrical system $A\ B^*\ C^*$ forming an equilateral triangle on base A.

The two-phase system DE may be obtained by joining the vertices of both vector triangles. It will be understood from fig. 1 that: $B=B^*+D$ (1), and $C=C^*+E$ (2) and $D=-E$ (3).

As shown in fig. 2, an unsymmetrical three-phase current system ABC may thus be assumed to be composed of the symmetrical three-phase A, B^*, C^*, and the single-phase current D flowing in the lines 2 and 3.

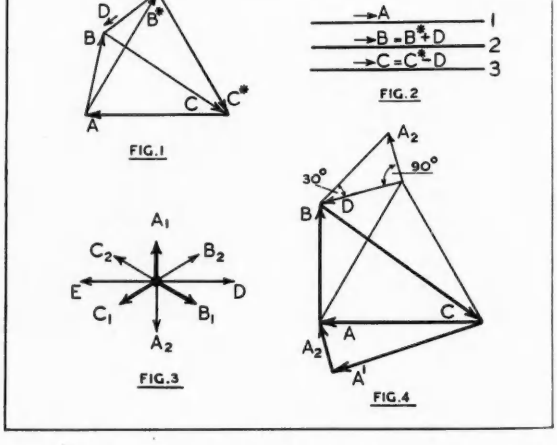
According to fig. 3 the two-phase vector system DE may be replaced by the two symmetrical three-phase systems A_1, B_1, C_1 and A_2, B_2, C_2, the former being clockwise and the latter anticlockwise. Their amplitudes are:—

$$|A_1|=|A_2|=\frac{1}{\sqrt{3}}|D| \quad . \quad . \quad , \quad . \quad . \quad . \quad (4)$$

e.g., $1/\sqrt{3}$ of the amplitude of the single-phase current.

Considering the energy conditions of the original unsymmetrical system A, B, C, it will be understood that the system A_2, B_2, C_2 is identical with the negative sequence component of A, B, C, and that the combination of both the clockwise systems A, B^*, C^*, and A_1, B_1 C_1 gives the positive component of A. B. C.

Construction of the positive and negative sequence components of the unsymmetrical three-phase system A, B. C is shown in fig. 4. Draw the diagram of the three vectors A, B and C and draw an equilateral triangle on one of the vectors†, for example on A. Join the vertices of the two triangles by a straight line, the line giving the vector D of



the single-phase current. Construct on the clockwise side of the vector D a 30 deg. right-angled triangle with D as base and the right angle on the side of the vertex of the equilateral triangle. The perpendicular of the right-angled triangle gives A_2, the negative phase-sequence component of A. Vector subtraction of A_2 from A gives A', the positive phase-sequence component of A.

* Symmetrical Component Theory, "Electrical Review," August 27, 1937.

† It does not matter which vector is taken as base, as I have proved in *Elektrotechnik und Maschinenbau*, vol. 54 (1936), p. 412.

SWITCHES AND PLUGS

What the Domestic Consumer Needs

By G. F. Sills, M.I.E.E., M.Amer.I.E.E.

THE standardisation of plugs and sockets is a logical corollary to the standardisation of voltage and frequency. From time to time flat-pin protagonists resurrect what most people thought had been settled, namely, that the standard for the country had already been decided as the round pin type, and without taking sides and going into the minor details of the construction of the two types it appears to me that one outstanding factor has been overlooked in the plug and socket problem.

It is right to say that in the intervening number of years the round pin plug and sockets now made by a few of the best manufacturers are definitely superior to those of a similar type made a few years ago when the flat pin plug itself had been made into a good job; in other words, a few years ago the flat pin was mechanically and electrically much better than most round pin types, but to-day there is nothing to choose in this respect, especially with the modern insulating material available.

I am referring to the better round pin type employing controlled flexible sockets, non-compressible pins, side entry plugs, &c. It is fair to admit that the advent of a first-class flat pin plug some years ago is partly responsible for the advance in construction of the modern three-pin round plug.

I have been buying recently a number of three-pin round plugs and sockets to B.S. 546/1934 of a leading make for my own use, and I cannot imagine anybody criticising these switch plugs and sockets. I have 35.3 kW of household apparatus of one kind and another. My maximum "units" used in a quarter are 5,907. For apparatus such as wireless, sunray equipment, sewing machine, lamp standards, &c., and for protecting anything from 5 A downwards, I use the recently introduced three-pin, 5-A plug embodying a single-pole cartridge fuse with a spare fuse in the lid, which can also be obtained with two fuses. This enables the more expensive apparatus to be properly protected, a feature which should be urged more often upon the buying public. Another real advantage of this little extra trouble is that only the piece of apparatus that is faulty is cut off, instead of perhaps a whole floor. Incidentally, the instructions regarding fuses should be moulded on the inside of these plugs instead of having a label stuck on the inside.

Two prominent enthusiasts of the flat pin recently informed me that they quite agreed that to-day's first-class round pin was now a really good job, but pointed out that the flat pin plug had an advantage in that a fused 5-A plug could be fitted into a 15-A socket, or superimposed into a 15-A plug, but there is now on the market a dual socket which I consider preferable. In the front of the fitting are 15- and 5-A sockets enabling both to be used simultaneously, the latter being fused with double-pole fuses for 1-, 2- or 5-A.

The disadvantage of the superimposed type of fuse plug is that when the apparatus controlled by the higher rated plug is required to be disconnected, the piece of apparatus controlled by the lower rated plug has also to be temporarily disconnected. One can easily imagine this being necessary several times in an evening. It seems an unnecessarily complicated movement. Furthermore, with the new arrangement, by using one or more adaptors, one can simultaneously use in addition one or more auxiliary circuits controlled by double pole 1-, 2- or 5-A cartridge fuses. This gives all the required flexibility.

To-day the round pin is considered the "standard" plug for use in Great Britain, as not only can it be made to comply with the I.E.E. Regulations, but has a B.S.S. Specification. Until all makers (including makers of imported plugs and sockets) of this type are forced to comply with these rules and manufacture to a minimum standard, the user will never have satisfaction. The Americans will not permit deviations from their standard in these respects. The same would apply if the flat pin had been adopted as a standard. Whichever type be used, it will be necessary to have only two amperages, viz., 15 and 5 and only three-pin plugs. The saving in cost of the 2-A type is not worth while.

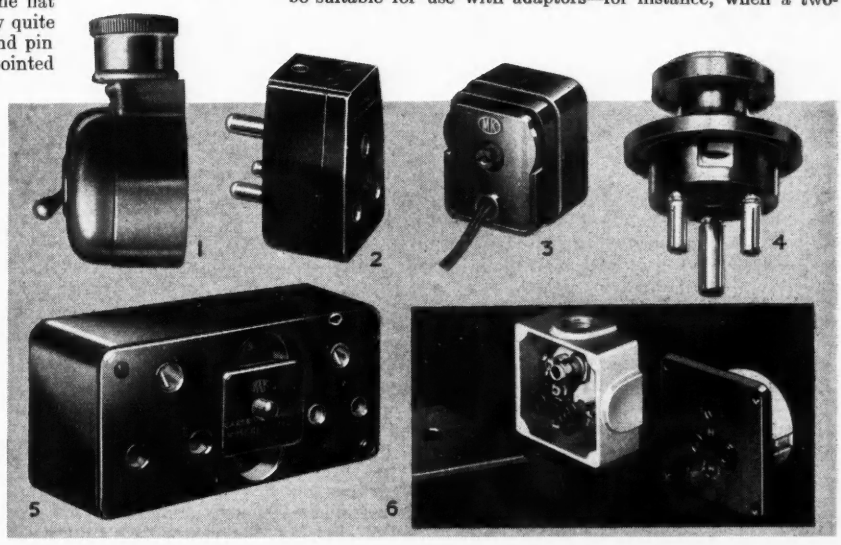
For years I have felt that the fetish of the use of sunk or flush type power plugs and sockets as distinct from lighting switches has retarded the sale of household electrical apparatus and lost the sale of millions of kWh. The cost of installation of the sunk type is higher, but perhaps more important is the tenants' natural feeling that the sunk type cannot very well be moved, except at additional expense in making good, and it sometimes ends in the user not putting in power plugs.

The surface type socket or switch control can be fixed to the skirting board without using a pattress, and even for 15-A only requires a half-inch hole through the floor where the skirting board joins the floor and two screws into the skirting board, the control facing the room. When he moves the tenant can take these away with a clear conscience, no damage to the skirting board, and with very little effort. Again, I am against the "hiding" of plugs in corners—an out-of-date subterfuge.

Too Many Varieties

I wonder how many people have looked through an up-to-date price-list of switches and sockets and plugs for household power and auxiliary apparatus, as issued by one of the larger well-known manufacturers. They would be more than amazed. I have a comprehensive list of one manufacturer, which consists of 127 pages, and no fewer than 75 of these pages are devoted to domestic plugs, sockets, switch plugs and connectors, excluding the usual lighting and cooking switches, &c. We must all agree that this is a deplorable state of affairs, through no fault of the manufacturer concerned.

I feel that three main types of control, as shown in figs. 1, 2 and 3, all three-pin for 15-A and 5-A, would meet practically all requirements, and those who want the sunk type and will pay could have it, but the mechanism would remain. The question of coloured covers for the sunk type is not taboo, as this is not complicated. The apparatus must be designed to be suitable for use with adaptors—for instance, when a two-way adaptor is used, the depth of switch base must allow clearance to the adaptor from the wall without use of a pattress.



A selection of plugs and sockets. 1. Tucker tumbler end-entry switched socket. 2. M.K. fused safety adaptor with 15-A and fused 5-A screened sockets. 3. Fused connector box with earthing facilities (M.K.). 4. Crabtree 15-A handshield plug. 5. Dual 15-A and 5-A d.p. fused socket outlet (M.K.). 6. Tucker shuttered socket outlets.

One must appreciate that many thousands of people in this country are of the opinion that they cannot afford a switch and plug, but only a socket and plug, but as the difference in price between the two is very little it is not a difficult matter to convince the public that they can afford to have a positive advantage, safety and convenience which will last

them for 25 years. In time, even poor people could appreciate this.

The horizontal type switch-socket with d.p. switch interlocked with plug should be used for better type installations, the obvious advantage being pointed out to the consumers, viz., full safety, and contacts must be home and so prevent over-heating. This is assured, as the switch cannot be closed unless they are.

For the same reason plugs cannot be pulled out even part way, and the "make" and "break" is done by the switch. The "kick" type switch obviates bending and the switch itself allows the plug to be left in after switching off. One loses a real convenience if a switch is not provided with the plug.

A good switch *must* be silent in operation. Most of them give a very penetrating snap which can be heard next door. In addition, the following should meet all problems of flexibility to suit the most particular person:—

A dual socket with screened entrances 15- and 5-amp (fig. 3), this socket having combined in it d.p. 1-, 2- or 5-A cartridge fuses, enclosed in a safety carrier; these fuses to be capable of being renewed without danger of touching live metal.

A fused adaptor (fig. 4) for use with 15-A socket or switch socket with 5-A outlet, both of the sockets of the adaptor being fitted with screened entrances, the 5-A side being fitted with d.p. cartridge fuses.

A 5-amp. twin adaptor with screened entrances without fuses.

A fused connector box (fig. 5) with one or two cartridge fuses and earthing facilities and capable of housing at least one spare fuse. This box to be such that the supply cannot be accidentally interrupted, to make it suitable for clocks.

A fused 5-A plug with one cartridge fuse and spare.

A fused 15-A plug with one fuse and spare.

A 15-A finger shield plug without fuse (fig. 6) and a 5-A finger shield plug without fuse.

I have heard it said that manufacturers of the round pin would be ready to make the flat pin if the latter became the standard, but there is no object in doing this at the moment if the majority are now satisfied that the round pin has been improved into a reasonable article, and thereby make, may-be, 30 million round pin plugs non-standard.

One has to remember that some years ago the same position held good in connection with the bayonet lampholder. The construction of this was not by any means satisfactory, but due to the pressure of competition the holder was so much improved that it is now competent for its work. Many people, possibly rightly, think that the screwed lampholder is a decided improvement for even ordinary lamps up to 100 W, but there would be the devil to pay if a householder had to scrap his bayonet-cap lamps on moving into a house wired for those of the screwed type, and the householder quite rightly takes the same line to-day in connection with plugs.

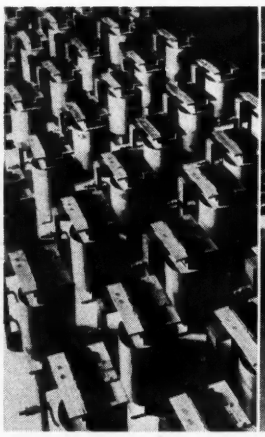
We must come to one common denominator for the consumers' sake, for it stands to reason that the consumer is the person who has to be considered, and he must not be saddled with two standards. That is my reason for writing this article.

Transformer Manufacture

"Berco" Factory Extended

INCREASED business in transformers has been responsible for the recent addition of a large new two-storey block to the works of the British Electric Resistance Co., Ltd., at Ponders End. All components required in manufacture, except castings, are produced in the factory, and great care is taken to secure that every unit is suitable for the class of work for which it is intended, special attention being given to the elimination of vibration and noise.

The cores are constructed of high-grade non-ageing silicon steel plates, each lamination being insulated on one side to prevent circulating currents. In addition, strips of insulating material are placed in every step of the core. In the large sizes the core leg packs are held together by heavily insulated bolts, varnished tape being used for binding together the laminations of the smaller types.



A section of the new transformer block at the British Electric Resistance Co.'s works with (left) a batch of transformers awaiting despatch

Generally the windings of the low-voltage coils are of the spiral type, "Elephantide" edge blocks keeping the coils in position and providing insulation to earth. The high-voltage coils are usually of the cross-over type and are connected in pairs, each one being separately taped and insulated between layers. Spacers are provided to give horizontal oil ducts if required.

All the windings are thoroughly dried before impregnation with varnish, the coils spending twelve hours at a temperature of 110 deg. C. in a thermostatically controlled electric oven. After this the coils are lowered very gently into the varnish and then have two to three hours in the oven at 80 deg. C. before a final twelve hours at 110 deg. C.

This method of impregnation is found by experience to give by far the best results, so Mr. Whitehouse, who is in charge of the transformer department, told us. Vacuum impregnation is used for the coils for high-frequency units.

"Berco" transformers are now made in sizes from 30 VA to 500 kVA. The models from 5 to 500 kVA include pole-mounting sub-station (indoor and outdoor) and pressure testing transformers. One of the many special types of apparatus which we saw when we visited the factory last week was a compact unit capable of withstanding a dead short circuit and intended to operate cinema arcs employing AC. Tappings on the primary winding giving about 10 V variation provide a convenient method of control on the arc.

Wherever possible, standardisation of components has been adopted. Only three sizes of core are employed and only six different plate widths. With these, however, any unit can be built up. Three types of small single-phase transformers in sizes from 30 VA to 2½ kVA have been standardised: a skeleton unit, an open type complete with terminal block, and a completely shrouded type. If required for tropical conditions the shrouded unit can be supplied with the casing filled with bitumen.

A fully equipped test room has been provided and tests are carried out at every stage of production. Coils are tested individually for short circuit and open circuit and all insulated core bolts are tested at 2,000 V to earth. After assembly each unit is subjected to the full B.S.S. tests.

While we were at the factory Mr. Paul Huhne, the managing director, also took us for a quick look round the resistance department, where we were shown the new "Bercohm" units which have been developed to withstand considerable temperature rises under tropical and corrosive atmospheric influences, while remaining constant in resistance value.

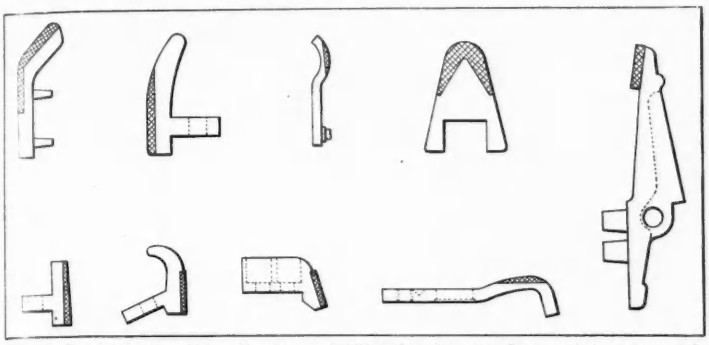
These units, which are wire wound on a highly vitrified body and embedded by a special process with vitreous enamel, have been subjected to drastic humidity chamber tests and overload tests of 200 per cent. and are guaranteed to ±5 per cent. of their stated values. A new continuous plant for their production is shortly to be installed.

HEAVY-DUTY CONTACTS

New Alloys Combining Desirable Properties

By L. B. Hunt, A.R.C.S., M.Sc.*

MODERN tendencies in electrical design are placing increasingly severe duties upon the contact material employed, and are making the selection of the most appropriate material a matter of some complexity. Larger currents are being handled, there is greater frequency of operation, the general tendency is towards reduction in the size of electrical equipment and the minimum attention and maintenance in service are called for.



Typical methods of application of Elkonite in the form of inserts and facings

TABLE I.—PROPERTIES OF CONTACT METALS.

	Copper	Silver	Platinum	Tungsten	Molybdenum
Melting point, deg. C. .	1083	960	1755	3400	2620
Specific resistance, microhms per cu. cm.	1.72	1.63	10.0	5.51	5.7
Thermal conductivity cm. cal. per sq. cm. per sec. per deg. C.	0.92	1.006	0.166	0.476	0.346
Temperature coefficient of resistivity ...	0.0039	0.0038	0.0031	0.0045	0.0033
Brinell hardness ...	90	60	90	290	150

Troubles due to erosion and sticking as a result of arcing have naturally increased, while in addition mechanical wear has become more pronounced. Attention has had to be given, therefore, to the production of contact materials which will better withstand these conditions and at the same time will carry heavy currents for long periods without excessive heating or any physical changes.

Metals or alloys employed for contact purposes must in general fulfil certain fundamental requirements, although the combination of properties necessary may vary widely with the design and operating characteristics of the equipment in which they are used.

Related to the ability to pass current continuously is the property of contact resistance, an increase of which during operation is responsible for heating at the surfaces. The most prevalent cause of increased contact resistance is the formation of oxides of comparatively high resistance; the consequent rise of temperature usually leads to an increase in oxidation, and thus, to a state of cumulative heating and oxidation.

Copper contacts are particularly susceptible to this defect. Silver, on the other hand, has an oxide of comparatively low electrical resistance, while the contact resistance of the metal itself is lower than that of copper. But, unfortunately, it has very poor hardness, and will not withstand mechanical wear. Moreover, its low melting point leads to more rapid erosion by arcing making it unsuitable for heavy currents.

A contact material should possess high electrical and thermal conductivity in order to deal with heavy currents and also to allow the rapid dissipation of heat from the contact surface. Copper and silver have advantages here, but metals of greater hardness and higher melting points, such as platinum and tungsten, have comparatively poor conductivities.

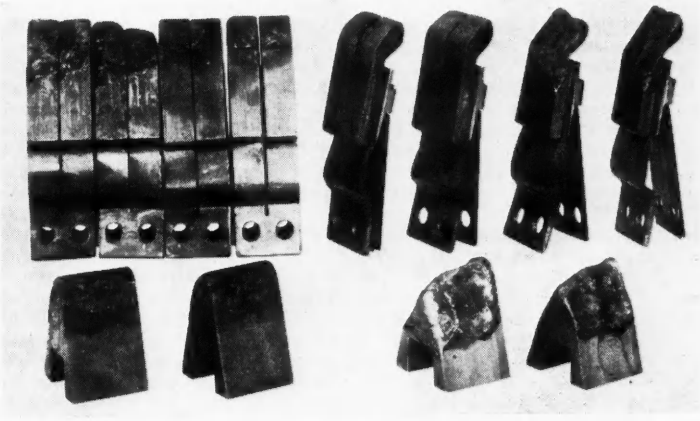
The properties of some of the principal contact metals are given in Table I, from which it will be seen that none of the metals possesses the optimum combination of properties to withstand severe contact duty, although each has some desirable characteristics. Copper and silver have high electrical and thermal conductivities and low contact resistance; tungsten and molybdenum have high hardness and high melting points, and thus have much greater resistance to wear and arcing, but possess markedly lower conductivities. These metals can be employed where conditions of current, mechanical wear and desired life permit, but where onerous conditions exist or when failure by sticking must be avoided at all costs there is clearly a need for something better.

Combination of Properties

Unfortunately the possibility of combining the properties of one of the softer, higher conductivity, metals with those of a hard, refractory, metal by the usual methods of alloying does not exist, as the two types of metal are so widely different in properties and melting points that the simple addition of one to the other in the molten state cannot be carried out, while the melting of a metal having a melting point of the order of 3,000 deg. C. is not a practicable proposition.

However, by the development of an ingenious method of high-temperature treatment, it is possible to prepare combinations of two metals in which the desirable properties of each type are retained to a large extent and in which the individual particles of each metal are very finely divided and evenly distributed so that the effect of a true alloy is closely approached. This technique was developed by the research laboratories of the General Electric Co., Schenectady, and later by P. R. Mallory & Co., Inc., Indianapolis, and their British associates Mallory Metallurgical Products, Ltd.

The commercial application of this method has resulted in the production of a range of specialised contact materials known as "Elkonites," which fall into two grades, according to the nature of the low melting point constituent. One series consists basically of copper combined with either tungsten, molybdenum or their carbides, while another comprises silver combined with one or more of these refractory metals.



Copper and Elkonite arcing contacts in oil circuit-breaker after tests between 20,000 and 40,000A at 4,200V

The copper alloys are used primarily for operation in oil circuit-breakers, and the silver alloys for operation in air, the former being less affected by oil.

TABLE II.—PROPERTIES OF ELKONITE MATERIALS.

Principal constituents	Specific resistance microhms per cu. cm.	Conductivity per cent.	Brinell hardness
Copper and tungsten (Grade 0W3)	4.59	38	140
Copper and tungsten (Grade 3W3)	5.39	32	160
Silver and tungsten carbide ...	2.88	60	105
Silver and molybdenum ...	3.45	50	140
Silver and tungsten	3.84	45	180

*Technical manager of Mallory Metallurgical Products, Ltd.

The properties of several typical Elkonite materials are given in Table II. They successfully combine the desirable qualities of the softer metals of high conductivity with those of the harder, wear-resisting refractory metals and are characterised by long life, freedom from sticking and lower maintenance.

All grades of Elkonite are normally used as facing material only, being attached to a copper or copper-alloy backing by silver brazing or mechanical union. The silver-bearing grades are also used in a variety of applications in the form of either copper-backed or steel-backed rivets for use in relays and contactors, the contact discs being brazed to the backing metal in a high temperature hydrogen furnace. When using rivets of this type one flat contact is generally used in conjunction with one having a convex surface with a radius of say 1 in. This combination is practically self-aligning and operates very efficiently, although for special cases better results are sometimes obtained with a larger or smaller radius. The thickness of the facing on contacts of the rivet type depends upon the diameter, but for small rivets not greater than, say, 0.25 in. a thickness of 0.050 to 0.060 in. is normally sufficient.

In large oil circuit-breakers arcing tips of a copper-tungsten combination are used. For air-break contactors advantage is taken of the much greater resistance to oxidation of silver by comparison with copper. The choice of alloy depends to a large extent on the maximum current which may have to be handled. A silver-tungsten carbide combination is normally employed as an arcing tip where high voltages and currents up to 5,000 A must be carried.

Tungsten carbide is highly resistant to mechanical wear under conditions where the make and break is very frequent, and also has a tendency to quench the arc and to prevent arc hangover. A silver-molybdenum combination is used where current densities are not extreme, but where the facing may have to carry a current up to 10,000 A.

Where pressures are high and where the contactor must withstand appreciable mechanical wear, the silver-tungsten combination is generally employed, but as an arcing tip only for peak currents up to 40,000 A and not for carrying the current after the circuit is made. It has been tested on a dead short circuit of 20,000 A and found not to weld.

"Nesco" Jubilee

The Company's Pioneering Work and Present Activities

AFTER fifty years of public service, the North-Eastern Electric Supply Co., as the organisation is now called, shows every sign of maintaining for at least another half century the health and vitality that have always distinguished it. While it may be fairly claimed that the North-East Coast is the cradle of electricity supply, we had first-hand evidence on our visit to the Tyne last week that the old concern has no intention of resting on its laurels.

As the prototype of large-scale undertakings throughout the world, the company, on the initiative of Dr. C. H. Merz, pioneered high-voltage three-phase transmission (leading ultimately to the grid in this country and similar schemes abroad) and modern generation practice, in addition to comparatively (but only comparatively) minor details such as balanced protection, system control, turbine bleeding, inter-stage steam reheating, closed-feed systems, the use of metalclad switchgear and last, but by no means least, a consumers' department organised to secure as load everything that could be economically electrified.

One source of the company's strength is that it has not shirked taking the rough with the smooth or feared to cast its bread upon the waters. As an illustration of this, its network serves not only the industrial districts of the Tyne, Tees and Wear, but also outlying areas so sparsely populated as to preclude the likelihood of commensurate return for some time to come.

An Efficient Power Station

Just as the original Carville power station was a Mecca to electrical engineers thirty years ago, so is Dunston B. to-day. The latter, which sends out more than half of the 1,250 million kWh or more generated in the company's stations, is known best for its adoption of the reheat cycle which, together with its high load factor of 61.8 possible with the completion of the frequency change-over, was doubtless an important factor in bringing the station to second place in the last official returns (1937) with a thermal efficiency on kWh sent out of 27.38 per cent. Since then it has been running very well, and the publication of an even better figure shortly will not surprise us.

The reheat cycle is sometimes said to introduce complications in operation, but these are not evident at Dunston, which is, of course, a base-load station in which the running up and shutting down of plant is infrequent.

A 50,000-kW turbo-alternator was put into commission a couple of months ago, bringing the installed generating capacity of the station up to 200,000-kW. The new turbine differs in appearance from its predecessors in the elevation of the casing at the high-pressure end, covering the Parsons later arrangements for running the connections from the steam chest to both top and bottom of the cylinder.

The addition of a further chimney has enhanced the appearance of what was already a pleasing type of building. It is indeed regrettable that glass-walled turbine and boiler houses will probably not be incorporated in power stations of the immediate future. Over its portals is significantly inscribed just the date, "1933."

It is little compensation to observe how efficiently air-raid precautions have been taken in hand. The necessity has been faced with vigour. The whole of the staff and operatives are put through a several-day course under skilled supervision and carry out drill at definite intervals to meet all contingencies.

In the event of an air raid certain key men would remain at their posts in the shelter provided by steel huts, each large enough to protect three men from splinters. The others would retire to a system of ferro-concrete trenches outside the station capable of holding 240 people, and proof against blast, splinters, gas and thermite.

Three galleries, each with seating accommodation, water and sanitary arrangements, radiate from a central point to which entry is made from outside through an air lock. In other bays are a dressing station and a compartment containing a 50-V emergency lighting battery and the air filter and fan. The latter circulates the purified air through the trenches under pressure (about 5 lb. per sq. in) in order to prevent the chance of the ingress of unfiltered air. It is normally driven by an electric motor, but a petrol set is installed as stand-by.

The gas-squad on return to the trenches first of all remove all outer clothing in a special room and throw it into bins ready for subsequent decontamination. Boots are removed when sitting on a wooden bench that divides the room into two section; the men then take off their underwear, which is put into other bins. After covering themselves with bleaching powder they pass through a shower bath into a dressing room.

Control Improvements

While in Newcastle, we took the opportunity of visiting the control room at Carliol House. Several interesting modifications and additions have been introduced since we described the arrangements on the occasion of the official opening of Dunston B. in our issue of February 10th, 1933. There is, for example, the remote operation, by means of two pilot wires, of the high-voltage side of the 66-kV sub-station at Spennymoor, where three 24,000-kVA transformers feed several local 22-kV networks, any secondary switching being carried out by a fitter who is normally engaged on maintenance work. Full indications are given at Carliol House of electrical conditions at Spennymoor.

A somewhat similar system is employed for controlling the Hexham centre. As the switching points are served by overhead lines and nine out of ten faults are transient in character, any interruptions can be dealt with immediately. With all the addition of recent improvements, however, the principle of centralised load dispatching remains the same as it was when originated by the company many years ago.

Old Employees' Association

On March 24th, the eighth annual dinner of the N.E.S.C.O.E. Association (the last two letters stand for "old employees"), as was befitting in the jubilee year of the company, was held in Newcastle-on-Tyne, with its president, Mr. R. P. Sloan, in the chair. There were about 130 present, including a good sprinkling of serving members of the staff.

Lieut.-Col. S. E. Monkhouse (managing director, North-Eastern Electric Supply Co.) was the guest of the Association, and in a brief speech he referred to Mr. Sloan as the keystone of the edifice, to whom it was due that the undertaking was not only a cradle of the many men who had attained to eminent positions, but also a source of lifelong friendships.

Mr. Sloan urged all who might leave the company's service to get into touch with the hon. secretary, Mr. W. G. Bass, 506, Bush House, Strand, W.C.2, with a view to becoming members of the Association.

ELECTRICITY TARIFFS

Comments on British and Foreign Practice

STATE regulation of electricity supply tariffs was the subject of a joint paper by Mr. J. W. Beauchamp (formerly with the C.E.B. and original director of E.D.A.) and Mr. R. Kauffmann (formerly with the "Bewag," Berlin), which was read at the Institution of Electrical Engineers in London yesterday, March 30th.

The authors' aims were to present details of recent legislation in Germany and France, in both cases by decrees, for the standardisation of tariffs by their unification and to compare such action with tendencies in Britain.

The paper commenced with an explanation of two decrees issued last summer in Germany by the Reichskommissar für die Preisbildung (Reich Commissioner for Price-framing) and communicated to members of the Wirtschaftsgruppe Elektrizitätsversorgung (economic group, a public body under which the whole electricity supply industry is compulsorily organised).

The new "rules" embraced all sales by all public suppliers to four classes of consumers, namely, domestic, commercial lighting, small industrial power and rural; the limitation to low-voltage consumers was implied, not stated. One of the objects was to establish just four classes; further sub-division was not encouraged, but in all other business, particularly supplies at high voltage, the suppliers were not interfered with, with the important exception of bulk supplies.

A leading principle was the compulsory introduction for the four classes mentioned of two all-in (two-part) tariffs at the option of the consumer. The fixed charge was higher in one case than in the other, but both must be absolutely comprehensive and include the costs of metering, accounting, &c. The lines along which the fixed charges must be established were discussed in the paper, showing that fundamentally the supplier was completely bound as to the form permitted, but each individual undertaking was quite free regarding the amount of the fixed charge it could make.

The distinguishing factor between the two tariffs was the kWh price. Maxima of 8 and 15 pfennig respectively (1.6d. and 3d. at the new parity, or 1d. and 2d. at the old) were imposed. A flat rate tariff, with certain qualifications, must be offered as an alternative to the smallest consumers, including those with "low utilisation of their installations." These concepts were not accurately defined, common sense being relied on to indicate when a consumer could describe himself as "very small" and apply for the flat rate. The latter could be combined with the two-part tariff, so that at the end of the year the consumer would be charged on whichever was the more favourable to him. The kWh charge was regulated in much less detail than the fixed component.

Basis of Fixed Charge in Germany

For domestic purposes the fixed charge was based exclusively on the number of "habitable" rooms with one kitchen. For commercial lighting and small industrial power the basis of assessment was principally demand, computed on kW or kVA installed, actual, or contracted for, with a possible alternative for lighting based on area and class (three) of rooms. For rural consumers both the area and demand principles were applicable, but there must be a further option based on area in "agricultural use," excluding streams, woods, grazing land, &c.; and, furthermore, separate accounts could be obtained for the household. It was compulsory to offer all consumers an off-peak price of not more than 4 pfennig per kWh.

The ultimate date by which the new "rules" must be adopted had not yet been announced, but all suppliers of over 300,000 kWh per year had to adapt their rural tariffs by January 1st, 1939. All new tariffs must be submitted to the Reich Commissioner for his consent and his rulings would have a much stronger unifying effect than the mere wording of the "rules."

The authors' impression of the proposals was that while the external shape of tariffs all over Germany would be very similar, the actual cost of electricity to consumers served by various undertakings might differ rather widely. That was not contrary to intention, for the legislation seemed to aim at making prices comparable, and by such comparison eventually to lower them generally, so securing similarity. How quickly literal unification would be achieved in Germany depended on how the Reich Commissioner would speed up the process of equalisation.

Actual figures were not yet available, but for comparison similar existing "Bewag" tariffs (Berlin) were tabulated in the paper, together with examples of typical well-electrified homes of the wage-earning classes, remembering that the wage level was somewhat lower than in Britain. Germany was distinctly colder in winter, which the authors stated was a great obstacle to the introduction of electric heating and cooking. Domestic consumptions and costs in Britain were also tabulated in the paper, classified according to types of appliances.

The hire-purchase system inaugurated by "Bewag" in Berlin was described, it having rapidly become popular as the trend in Germany was definitely against undertakings selling apparatus. The "Schufa" co-operative reference organisation included practically everyone who did business on the instalment plan. It was reliable and inexpensive.

A Government regulation might be expected soon relative to the standardisation of domestic appliances, with a view to reducing the number of types in use and thereby lowering their prices.

Tariffs in France

A certain unification was also imposed in France last summer by decrees. From January 1st, 1939, all customers must have the option of a tariff for cooking and related purposes, provided they accepted it for three years and reached a fixed yearly consumption (total and per kW installed). The cooking installation must be separately metered, the maximum kWh prices varying from 20 to 50 centimes (¼d. to ⅝d.) according to geographical situation and the importance of the towns and villages concerned.

France decided against a two-part tariff in favour of a three (or more) step or block system; the number of kWh in each step, excepting the last, depending on the number of rooms, the area of the flat, or on such other factors as might be arranged between the supply and local administrative authorities. Existing two-part tariffs need not be altered. Block tariffs must be offered to both domestic and agricultural consumers with installation limits between 1 kW and 5 kW, on a two years' contract.

The French rules for the block tariff were much more complicated than the German ones, and were chiefly of local interest only. They were much more generous than the German in assessing secondary rooms. In both countries the offer of an alternative off-peak tariff was obligatory, and bulk contracts must be amended to enable distributors to keep within their prescribed price limits. One French tendency went beyond anything decreed or even suggested elsewhere, for within a department (county) a majority of communities could impose on all communities a uniform tariff.

The authors pointed out that although the German "rules" did not present many new concepts they were logical and practical at the same time, and when handled in a liberal spirit by the Reich Commissioner would produce results helpful to those considering the matter in other industrial countries.

The trend of the French rules was not very different from that of the German ones, but owing to the fact that they were part and parcel of a legislation concerned with all aspects of French economics they did not so much touch fundamental matters but were satisfied with adding patches here and there.

Another reason for the less comprehensive character of the French rules was that, as distinct from Great Britain and Germany, the bulk of electricity supply was in the hands of companies (not the municipalities or the State); there was also the ingrained French respect for property interests.

British Tendencies

In the second half of the paper the authors commented on current British tendencies affecting tariffs. They contended that standardisation of tariffs was almost necessary, to enable comparison to be made, but when catering for very large users of any class complete freedom of action was necessary to meet the competition of private plant and to afford security for a reasonable period. Although for large industrial supplies charges based on measured demand and kWh consumption were the most scientific, there was to-day greater readiness to substitute block or discount rates. As industrial establishments specialised more narrowly they presented load factors peculiar to their businesses and not susceptible to alteration by any ordinary variation of charge for electricity.

In a few years the domestic demand in this country might dominate the supply situation. In that event, and with houses averaging 5,000 to 15,000 kWh per annum (say, 1,500 to 4,500 kWh per head), the basis of the fixed charges imposed at present might become less sound, perhaps even undesirable, and with advantage replaceable by annual minima, or a secured revenue against overhead costs collected rather in the form

of a guarantee to use regularly certain appliances and methods in the home.

When a very high average use of electricity was reached in some millions of homes a simple form of block tariff with a minimum payment might well satisfy most needs. It was necessary to consider not only the trend of electrical application, but also changes in the layout of buildings which might make a floor area basis of charging more representative of electrical demand than a per room basis.

The paper next reviewed leading methods of establishing fixed charges, pointing out that in 1937 some 233 undertakings (37.5 per cent. of the total) covering about 36 per cent. of the population were offering the rateable value form of domestic two-part tariff.

The suggestion that electricity could be supplied to the home without limit for an inclusive annual fixed charge could not be justified, but charging by the kW-year might perhaps be a solution.

The rate at which homes were being electrified proved that appliances were now efficient and reliable and that supply and service were being sold on a price level which satisfied the user and induced him steadily to forsake coal and gas. The domestic cooker might be an index. The number in use had increased on the average by over 200,000 annually for four years, reaching 1,103,000 in 1937. This gave an average of 129 cookers per 1,000 consumers, but in highly developed areas figures of 300 to 500 had been attained. These figures were probably within a small percentage of accuracy.

The consumer's overall expenditure comprised both energy and consuming appliances, and experience had shown that the time had not yet come when low rates for energy alone would create an extensive domestic business. This, the authors said, pointed to the need for more statistics and they suggested means by which they might be obtained, in order that the usually very simple two-part tariff could be established in a far more scientific way than had yet been done.

The Heating Load

The period of unusually cold weather at the end of 1938 revealed a great deal of submerged load due largely to the use of heating appliances, but also reinforced by extra cooking and the failure of some alternative water-heating devices.

In all cases one was apt to give too much consideration to the high cost of meeting exceptional loads and too little to the real solution, which was to bring about so general a use of the appliances throughout the year that the revenue derived from them would support occasional abnormalities and make it as unnecessary as it was undesirable to check the consumer in the fullest employment of a service whose advantages had been so persistently advertised. Even the radiant electric fire, far as it was from the ultimate method of applying electric heat, need not be feared if it were supported by an ample background of cooking and water-heating consumption.

In short, because electric heating was still too much of a standby or supplement, a condition encouraged by the cheapness and simplicity of the ordinary radiant fire, the remedy was not in restricting this habit-producing application which gave so much satisfaction to the user, but in the evolution of improved ways of applying electricity to the heating of buildings, and making it, as was the case with lighting, an element in the design and layout of the house. In this direction research seemed to be far in advance of practice, and the time might have arrived for supply engineers to offer the public hire facilities for more extensive and permanent heating equipment, with skilled advice on its adaptation to the various needs of the home.

New S.A. Power Station

IN cutting the first sod for the construction of a new power station on the River Vaal at Vereeniging last week Dr. Van der Bijl, chairman of the Electricity Supply Commission, said that the system in course of construction was one of the largest and probably one of the finest original systems of power supply in the world. He announced that a new steel works was planned for Vereeniging, to be started as soon as the international situation cleared up.

Situated on the Orange Free State side of the Vaal River, the new power station will be the largest in the province; the total ultimate cost is believed to be nearly £4,000,000. With a colliery adjoining, the station is expected to set a new standard for cheap electricity. Designs have been completed for cooling towers 320 ft. in height and 220 ft. in diameter at the base—the largest in South Africa at present are those at the Klip power station, which are 250 ft. high. The power station, which will be operated by the Victoria Falls and Transvaal Power Co. on behalf of the Electricity Supply Commission, will have an initial capacity of 100,000 kW, which will be increased in time to 200,000 kW. Arrangements have been made for the enlarged Klip station (431,000 kW) and the Vaal station to be ready on approximately the same date towards the end of 1941.

Here and There

By Nomad

AT the conference of the Association of Public Lighting Engineers last September I could not get a very clear view of the attitude of the members towards the Report of the Ministry of Transport Committee on Street Lighting, largely because feelings were then still running rather high on this and other subjects. Now, however, after a six-month period of "consolidation" I find that most street-lighting authorities are using the M.O.T. Report at least as a guide and there appears to be little indication that development is being held up pending the issue by the British Standards Institution of the specification on public lighting, and I think it is generally expected that the specification will be very much on the lines of the report.

* * *

Although there is ample evidence of the increasing use of sodium vapour lamps, I am not sure that the relative spurt of a few months ago has been maintained and I suspect that the continued development of mercury colour correction is influencing the position. So far as I can ascertain there is no immediate prospect of colour correction in the case of sodium. The efficiency of the sodium lamp is, of course, higher than that of the mercury lamp, although some advance has been made recently towards improving the output of the latter. But among users of the sodium lamp I find that much is said for what is claimed to be the superior contrast between the object and the road surface afforded by that type.

* * *

To my mind there can be no doubt that in the public lighting field the right policy is to buy the best in electrical equipment, because of the unusual maintenance problem presented by the inaccessibility of the light source and because the safety factor is so particularly pronounced in this case. Yet the tendency to buy on price seems to be as marked as ever and I feel that educational work in this respect is vitally urgent. Mr. Garry, of the British Thomson-Houston Co., Ltd., greatly impressed me on this score recently when he said that the approximate overall cost of a main-road lighting unit is £25 to £30, of which the lantern costs, say, £3 to £4. It is in connection with the lantern that the greatest tendency to buy on price is found, but he thought that if, say, an extra ten shillings for a better-quality lantern were considered as 10s. on the overall cost of the unit (£30) instead of on the cost of the lantern (£4) the standard of public lighting would be raised considerably.

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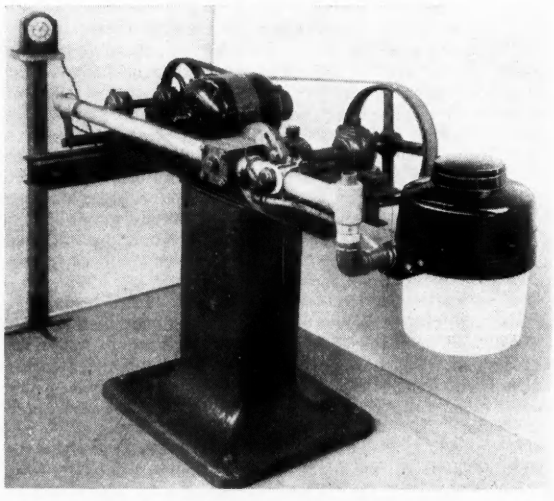
One of the most interesting aspects of modern public lighting development is the necessity to counteract the extra vibration to which lamps and lanterns on trolley-bus poles



Machine for subjecting lanterns to simulated and intensified trolley-bus bracket-arm vibrations

are subjected owing to the double trolley arm. Mr. Villiers, of the General Electric Co., Ltd., showed me recently some of the exacting tests applied to lanterns nowadays, including a vibration test which has been instituted directly as the result of this extra vibration. On a motor-driven machine the lanterns are subjected to reproductions of the vibrations of a bracket arm with such intensity that the strain of years of service is simulated in a few hours.

MEETINGS AND DISCUSSIONS

Suggestions for Improving Industrial Sales. Problem of Humidity in the Textile Industry. Methods of Testing Protective Gear

In the discussion on Mr. W. E. Swale's paper to the E.P.E.A. last week the need for the co-ordination of statistical information was emphasised. It was thought that the salesman dealing with industrial loads must be an engineer. A number of interesting lectures describing the results of research in the textile industry were given at the conference on industrial physics held last week at Leeds, the speakers including Dr. C. C. Paterson, director of the G.E.C. research laboratories.

Developing Industrial Sales

INDUSTRIAL sales development was dealt with in a paper by Mr. W. E. Swale (power sales engineer, Manchester Corporation) which was summarised in the ELECTRICAL REVIEW of January 20th, 1939, page 90. The same paper was repeated before the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on March 21st, and in the subsequent discussion Mr. W. J. Oswald, the chairman, disagreed with the statement in the paper that the demand in the domestic field would fall off. While in his area (Wimbledon) only 0.5 per cent. of the houses were not connected, in other areas the percentage was very much larger, so that there was a great deal yet to be done there.

Speaking with regard to the industrial load, he stressed the importance of the supply authority's experts discussing with manufacturers the details of their processes and of pointing out ways and means whereby the amount of electricity used could be reduced. That had been done in his area, and although the immediate effect was a reduction in demand, the ultimate result had been all to the good and the load on the undertaking generally was constantly increasing. There were many cases in which engineers were averse to extending their mains and were consequently holding up development. The view was also expressed that the salesman dealing with industrial loads must be an engineer and, at the same time, very versatile. It was urged that information about the application of power to industry should be sent to E.D.A. so that it could be widely disseminated to assist engineers engaged in this work all over the country.

Co-ordination of Statistics

Mr. C. H. de Nordwall (power development officer, E.D.A.) expressed satisfaction at the suggestion by the author of the appointment of a national committee for co-ordinating statistical information, and said his experience had been that too many engineers were most reluctant to give information with regard to new installations. Perhaps they would be more willing to give it to a national committee. On the question of special tariffs for special industries, he said it would be necessary to get over the provisions in the Electricity Supply Acts against giving preference. When negotiating contracts the salesman should not give a definite price until it was practically certain that the prospective consumer would take electricity because he had heard industrialists say that electric power salesmen conducted a sort of Dutch auction with regard to tariffs. He agreed with the author's suggestion that a research committee should be set up to investigate the uses of electricity, because the research work carried out by manufacturers was to improve their apparatus only.

Mr. Swale said he was not in favour of setting up a national committee for collecting statistics, but a committee might be set up within some existing organisation for this purpose. It should be possible to arrive at some agreement as to the manner in which essential statistics should be prepared, and in saying this he was not merely thinking of the statistics for the Commissioners, but of statistics which would be of the greatest value to the industry as a whole if distributed among the various undertakings.

He agreed that special tariffs were a problem, but it all depended on the orthodoxy with which an approach was made. There must not be differentiation between users in like circumstances, but there could be as between one class of consumer and another. The approach to the consumer must be psychological, and the most important thing was to convince him of the other advantages of electric power, leaving the tariff to the last minute. A local undertaking staffed by good people could bring to the notice of smaller consumers information which they needed by way of local demonstrations in the consumers' own workshops, and that sort of thing would soon develop new uses of electricity if there were the necessary co-operation.

In reply to another speaker, he said he was convinced that the two-part tariff was essentially sound, because with a low secondary charge it was possible to develop off-peak loads which could not be done with a flat rate. It was true, however, that many people in Lancashire refused to have anything to do with the two-part tariff, possibly owing to their disastrous experiences during the slump. There were other ways of dealing with special industries. For instance, in the rubber regeneration industry he had several works on the mains which closed down completely during peak hours and got their electricity at half the standard rate.

Mr. C. T. Melling said chief engineers should not retain too many duties, but should delegate some of them to specialists on their staffs who could discuss problems in any particular industry with those engaged in it. Power business could only be obtained by discussions in the actual works.

Mr. G. M. S. Sichel also stressed the importance of going into manufacturing works and studying the processes and indicating how electricity could be applied most efficiently. Although at first sight it might not appear that the sewing machine load would be worth going for, it was remarkable what a big load could be built up from such small uses. In the same connection he said that the wireless load of Greater London required the equivalent of the whole output of one of the 75,000 kW sets at Barking.

Mr. Swale, referring to sewing machines, said there were nearly 400,000 garment factories in Manchester.

Textile Physics

AMONG the lectures delivered at the third conference on industrial physics, with special reference to the textile industries, arranged by the INSTITUTE OF PHYSICS and held last week at Leeds, was one by Prof. R. Whiddington (Leeds University), in which "humidity" was dealt with. He explained that it was now believed, with much experimental backing, that many fogs were produced on little crystals of common salt and sulphuric acid nuclei rather than, as was originally thought, on ordinary dust. Another important factor in the growth of water droplets was their electrical state. While an ordinary water drop would quickly evaporate because its vapour pressure exceeded that of saturation over a plane surface, yet by the addition of a soluble salt or by electrification, or both, its vapour pressure could be so reduced as not only to prevent evaporation but actually to make it grow.

When a fibre adsorbed moisture from the air its physical properties were in some respects changed. It became hot and when the moisture which it "regained" was removed, the temperature did not drop back to its original point, the reason being that there was a hysteresis effect, which was important in manufacturing processes inasmuch as the water content of a fibre at any humidity would depend on its previous history.

Change in Electrical Resistance

Other physical changes occurred and the electrical resistance altered. For example, a minute current at 2,000 V was passed through a number of parallel connected wool fibres. As soon as a steaming beaker of water was brought near them the current through the galvanometer increased enormously. It had been pointed out that for a given amount of water absorbed in wool (Marsh) the resistance was more than a thousand times that of columns of water the same size as the fibres. Therefore, channels of constricted shape must be within the fibres.

Again, when a fibre adsorbed moisture, it increased both in length and diameter as shown by a human hair placed between the plates of an electric condenser acting as a spacing piece. As the hair was drawn through the condenser and as the damped end passed through, the capacity of the condenser diminished.

Dr. Ezer Griffiths described some of the work of the National Physical Laboratory in relation to the development of hygrometers to meet special requirements. For example, a multiple thermo junction form of wet and dry bulb hygrometer had been devised that enabled the "wet bulb depression" to be observed directly, and the air temperature by means of a resistance thermometer.

Dr. M. C. March (Cambridge Instrument Co., Ltd.) dealt with process control, mentioning that solution densimeters could easily be converted for automatic control. Also, by means of a suitable electrode system, it was possible to re-

duce the measurement of pH to that of an EMF which occurred in a circuit of high resistance and, therefore, a valve arrangement was necessary for its measurement. For many purposes it was possible to work with the electrical conductivity of the solutions and even to arrange for compensation for changes of temperature. One could measure the colour of solutions and control their strength automatically by photo-electric cells. For the photo-electric measurement of the levelness of yarn, an image of the yarn was thrown on to a slit behind which was a photo-electric cell; the amount of light falling on the cell showed an increase with the decrease of the diameter of the yarn.

A moisture meter consisted of two electrical condensers formed by metal plates. With the fabric between one pair, the other pair was maintained with the same distance between them but contained no fabric. A high frequency AC bridge was used to measure the ratio of capacities, which depended again on the moisture content. This apparatus could be used for controlling the speed of a drying machine.

A lustre meter enabled the surface of a fabric to be illuminated at any angle and the amount of light given off at any other angle to be measured; an opacity meter, used in the paper trade for measuring the relative amounts of light given off by the fabric when backed with a white or a black surface, could be applied to the textile industries.

Automatic Regulators

Mr. D. Harrison (Negretti & Zambra, Ltd.) lectured on automatic regulators, remarking that if regulation could be effected by the final acting device, then there was much to recommend electrical operation, but if it were preferable to make the movement gradual, various other methods of operation needed consideration.

Dr. C. G. Darwin (Director of the National Physical Laboratory) dealt with means by which heat could develop in media when they were strained, showing how they could be used to change temperature. The use of vapours failed at about 1 deg. absolute because, roughly speaking, there was no vapour below that. Instead use had been made of "adiabatic demagnetisation." If a salt like iron alum was cooled with liquid helium as low as possible in a very strong magnetic field and then the field were broken off, the temperature would drop enormously from about 1 deg. to 3/1,000th of a degree. The atoms acted like little magnets swinging to and fro under the force of the external field. If that field weakened, their periods of swing would lengthen, like the motion of a pendulum of varying length.

If the period lengthened as it swung, its energy of swing decreased, and so in the same way the energies of the little magnets decreased. They, therefore, no longer had the proper equipartition amount, and to restore it they would borrow energy from the other parts of the system; for instance, the kinetic energies of the atoms. The result was that the body cooled; it did so at any temperature, but only slightly at ordinary temperatures, whereas at deep temperatures the change might be enormous. The process failed at about 0.003 deg. K, but methods had been proposed by which it was hoped to get to, say, 10^{-5} deg. K. The idea was to use a diamagnetic metal with nuclear magnetism.

Colour-rendering Properties of Light

Colour and its rendering was the subject chosen by the president of the Institute, Dr. C. C. Paterson (director of the research laboratories of the General Electric Co., Ltd.), who prefaced his remarks by saying that so long as light was produced by the incandescence of solids, colours would respond with reasonable consistency to the stimulation of the white light radiation. Nevertheless, for good or ill a change had come. A limit to the yield of light from incandescent solids had already been reached, but there were now gaseous sources of electric light giving upwards of three times the amount of light for the same electricity costs.

The carbon dioxide discharge lamp was unique in possessing colour-rendering properties probably more perfect than those of any other artificial source. It had an energy distribution very close to that of average north daylight, and in spite of its poor efficiency was finding increasing use in industry for critical colour appraisement.

When using artificial forms of daylight the choice of the most suitable would depend on the task to be performed, but international agreement had now been reached so far as colorimetry was concerned, by the adoption of illuminant "C," which was an artificial form of "average daylight" produced by a tungsten filament lamp operating at a colour temperature of 2,850 deg. K, in conjunction with the use of a specified colour filter.

Commercially, it was difficult to obtain a resultant energy distribution exactly the same as illuminant "C," and often the glass used for that purpose was slightly selective in its absorption. A point which should not be overlooked with regard to tungsten lamps, with or without filters, was that the colour temperature and, therefore, the colour-rendering properties, would change with changes in applied voltage.

There was such an immediate and pressing demand for simple techniques for measuring and specifying both the colour and colour-rendering properties of light, that there were likely to be a number of new proposals in the near future. Having, in the photo-electric colorimeter, a very quick method of measuring colour, why should they not make use of it to measure colour-rendering properties?

Testing Protective Gear

METHODS employed for testing types of protective gear (time-graded, balanced, directional and miscellaneous) commonly applied to three-phase AC transmission and distribution systems in this country were described in a paper by Messrs. F. H. Birch and J. B. Ritchie which was read before the London Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on March 28th.

The main requirements were outlined and systems classified according to principles utilised for discriminating between "internal" and "through" faults. Tests to be applied after installation and before putting the gear into service were next described, followed by a commentary on routine maintenance tests. For instance, the authors declared that a tripping test should be made not less frequently than every two months, and insulation tests once a year. Stability and operation tests should preferably be carried out at intervals of two years. By comparing maintenance with initial commissioning tests discrepancies would be revealed that would enable action to be taken.

The second part of the paper was more specialised, discussing the testing of particular types of protective systems. Testing current was obtainable from a generator run on short-circuit, which method was quick, easily controllable and could furnish the necessary heavy currents, but was difficult to manage at any distance from the power station.

A transformer could be employed, which was convenient and could be made transportable, but had not the required VA output to pass enough current through any but low-impedance apparatus; alternative ways of injecting test current into the secondary windings of current transformers were described.

The use of low voltage DC was a clumsy method and involved energy wastage, but load current (if sufficient were available) could be used for testing. To ensure that the margin of safety was adequate, all DC circuits should be tested with a 50 per cent. reduced voltage.

FORTHCOMING EVENTS

Institution of Electrical Engineers (*Informal Meeting*).—Monday, April 3rd. Institution, London, W.C.2. 7 p.m. Discussion on "Electric Signs," to be opened by Mr. A. H. Brackensey.

Wireless Section.—Wednesday, April 5th. Institution, London, W.C.2. 6 p.m. "Radio in Aviation: A General Survey with Special Reference to the Royal Air Force," by Mr. N. F. S. Hecht.

South Midland Centre.—Monday, April 3rd. James Watt Memorial Institute, Great Charles Street, Birmingham. 7 p.m. "State Tariff Regulation: Recent German Legislation compared with British Tendencies," by Messrs. J. W. Beauchamp and R. Kauffmann.

Western Centre.—Monday, April 3rd. Roll's Hall, Monmouth. 6 p.m. "State Tariff Regulation," by Messrs. J. W. Beauchamp and R. Kauffmann.

Tees-Side Sub-Centre.—Wednesday, April 5th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. "The Design and Operation of Hams Hall Power Station," by Mr. F. W. Lawton.

Rugby Engineering Society.—Friday, March 31st. Albert Buildings, Albert Street, Rugby. 7.30 p.m. Annual general meeting.

Association of Mining Electrical Engineers (*Lothians Branch*).—Saturday, April 1st. "Notes on High Rupturing Capacity of Switchgear," by Mr. F. C. Barford.

West Wales Branch.—Saturday, April 1st. "Air Blast Circuit Breakers in Mines," by Mr. W. E. J. Farvis.

Institute of Transport.—Monday, April 3rd. Institution of Electrical Engineers, London, W.C.2. 5.30 p.m. Joint meeting with the I.E.C. "The Incidentals of a Railway Electrification Scheme," by Mr. W. J. England.

Electrical Power Engineers' Association (Liverpool Section).—Monday, April 3rd. Widnes Technical College, Victoria Square. 7.30 p.m. "Sugar Refining," by Mr. R. G. Campbell.

Illuminating Engineering Society (Photometry Section).—Tuesday, April 4th. E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2. 7 p.m. "Analysis and Criticism of Some Visibility Meters," by Mr. C. Dunbar.

Junior Institution of Engineers (*Midland Section*).—Wednesday, April 5th. James Watt Memorial Institute, Great Charles Street, Birmingham. "Recent Developments in Automobile Electrical Equipment," by Mr. E. A. Watson.

CORRESPONDENCE

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Engineers and Managers

IN the leading article of your issue of March 3rd, you deal with a matter which is being increasingly debated in many sections of industry. For decades it has been a sore point with the technical man that whilst his skill and experience produce the goods, the more highly paid posts in industrial concerns usually fall not to him, but to the man whose commercial knowledge enables him to handle the distribution.

You set out in your article, the lines along which the electrical industry has developed. This, surely, is exactly what occurred in mechanical engineering after F. W. Taylor concentrated upon scientific production methods towards the end of the last century in America. The immense increase of goods made available by more efficient production inevitably led to the urgent need for an inquiry into the methods of distribution. That function, as we know, was as a result developed in the most intensive manner, but the development brought with it a fresh set of problems, affecting finance, accounting, the legal side (of hire-purchase selling, for instance) and personnel.

All this has ended, logically, in the industrial world having reached a stage in which the management of all these activities is beginning to be regarded as a science in itself.

This Institute was registered in 1922 as a specially authorised society for the promotion of education and in particular, education in the principles of industrial administration and their application. Its objects are the formulation of the standards of knowledge, training, conduct and experience which are desirable in the practice of industrial administration; the development of its science and technique by papers, conferences, and research; and the promotion of the education of students in the principles and practice of management. To-day instruction in industrial administration is provided in over seventy educational institutions in this country, and the number increases yearly.

It is not given to every man to possess that strong commercial instinct which, combined with qualities of leadership and sound judgment added to technical qualifications, makes the ideal administrator of an industrial concern. But at any rate those who have entered their profession on the technical side, and whose interests lie mainly in practical work, can no longer complain that the posts carrying with them senior management responsibilities are closed to them on account of lack of opportunity to remedy the one-sided nature of their early training.

Artillery House, S.W.1, *March 24th.* T. G. Rose
Chairman, Institute of Industrial Administration.

Hydro-electric Development

The article by Lt.-Comdr. R. B. Fairthorne in your issue of March 17th is particularly to be commended for the prominence it gives to load factor. On this question, in my opinion, the whole future of the transmission of water power depends, and the only fault I have to find with the figures is that he goes a little too cautiously.

The article seems to be designed for application in Great Britain and the interest charges and capital outlay point to an effort to introduce private capital. On the other hand, I feel that the untapped water-power resources in Great Britain are relatively insignificant, and can only be rather expensively obtained; low heads and large hydraulic works will characterise them and they will be relatively very costly. By going abroad very large water powers at comparatively high heads (and consequently small capital outlay) can be obtained.

The *amount* of the water power available is vital, because only thus can cheap transmission be obtained, as Rüdenberg has shown, and the transmission line is a great factor in the expense, so that the whole scheme becomes a question not for company promotion but for a Government loan. In such a case the interest charges may not be above 3½ to 4 per cent.

Again, while dam work (at the source) may be exceedingly expensive where *seasonal* variations in the supply of water are to be overcome by huge storage provision, yet a daily peak at the point of demand may be met (as regards the source of supply) by a relatively small charge on hydraulic works at the generating station.

Thus, supposing the source were a Himalayan river whose minimum rate of flow represented 500,000 kW this might, quite cheaply, be converted into a peak load of 1,000,000 kW or even 1,500,000 kW, which the transmission line would have to transmit. Where, on the other hand, cheap natural power is available in great quantity (as at the Victoria Falls) without the need for storage but is at present too far from large towns or seaports to be commercially demanded, full advantage of the natural "load factor" of the waterfall may be obtained, and a chemical load in a large town with a high load factor may still be catered for. To do this cheap transmission is in both cases essential and on that question I have concentrated for the past five years.

With regard to Table III I disagree with: (1) The interest charges exhibited, (2) the amount of power transmitted, (3) the load factor taken, and (4) the annual cost of generation, all of which might be greatly improved if it were a Government scheme in the Dominions or Colonies, and venture to suggest that Lt.-Comdr. Fairthorne's table does not make the water power look half attractive enough to get Government engineers interested.

The revised Table III, which I here submit, is based upon 80 per cent. load factor and £40 per kW. This is securable where, combined with extremely low cost of energy, powers are taken to *select* new industries demanding this load factor.

TABLE III (Revised).
1,000,000 kW = Maximum Demand

Rate of interest per cent. p.a.	Interest p.a. £	Depreciation at 2 per cent. p.a.	kWh p.a. at 80 per cent. load factor (thousands)	Management and wages, p.a. £	Total annual cost £	Cost per kWh. d.
6	2,400,000	800,000	700,800	730,000	3,930,000	0.135
5	2,000,000	800,000	700,800	730,000	3,530,000	0.121
4	1,600,000	800,000	700,800	730,000	3,130,000	0.108
3	1,200,000	800,000	700,800	730,000	2,730,000	0.093

Reverting again to artificially obtained load factors, in some cases there is water, in volume, at or near the point of demand (*e.g.*, Bombay, Cairo, Capetown, &c.). In such cases artificial lakes—of only a few hours' full load capacity—at a small elevation may possibly be obtained and may be pumped into and the load factor of the line *and* of the generating plant (at the source) may thus be brought up to 80 per cent. This means that we generate and transmit only 500,000 kW but deliver a peak load of, say, 1,000,000 kW. (The loss in conversion would not matter if the power were cheap enough at the source). This would be useful if the capital outlay on generating plant or dam were very heavy, owing to inaccessibility of site.

All these considerations, in my opinion, warrant the assumption of 80 per cent. load factor. In comparing my Table III with Lt.-Comdr. Fairthorne's Table II it must be borne in mind that the cost of coal will be much heavier in places like Cairo, Bombay and Capetown. A. M. Taylor.

Birmingham, *March 21st.*

Artificial Lighting

It is difficult to understand why the extraordinary ideas expressed by Mr. G. V. Downer on the subject of "Artificial Lighting" should ever appear in print. Must it be attributed to your generosity in allowing him one whole page in your valued periodical, or do you agree with the author?

Mr. Downer says, "we cannot see light itself," and then proceeds, "we do not want to see sources of light; the only exception is when the source of light is used decoratively."

Tennis can be played quite comfortably when daylight intensities are much less than one ft.-candle, and a correspondent seemed quite satisfied to write to you when the natural light from a northern aspect equalled four ft.-candles.

After thirty years' endeavour in the field of illumination I now read in a publication of your standing that my efforts only redound to the theory of one wax candle per square foot of floor area.

A long article could be written on this subject giving many authoritative examples to prove the absurdity of Mr. Downer's statements, and there are many in England who can do so better than I.

Please accept these observations from one who may be so unfortunate as to suffer from too high a value in natural light intensity. H. A. Tinson,

Manager, Lighting Department,
S.A. General Electric Co., Ltd.

Johannesburg, *March 14th.*

THE GAS INDUSTRY

Comprehensive P.E.P. Report

A VOLUMINOUS report upon the gas industry, the result of five years' work, has just been published by P.E.P. (Political and Economic Planning), 16, Queen Anne's Gate, S.W.1 (price 10s. 6d.).

It is not our duty to review this at length, interesting though it is; we can merely draw attention to such parts of the report as touch upon the relationships existing between the gas and electricity supply industries, and indicate the broad conclusions arrived at by the Committee which compiled the report.

Unusually, the summary and conclusions are placed first in the volume—quite a sensible arrangement from the point of view of those who have no time to absorb the whole of the report. Chapter I deals with the use of coal and shows that of the 182 million tons consumed in 1937 about 41 million were carbonised and 15 million were absorbed by the electricity supply industry. It is noted that in carbonisation over 80 per cent. of the potential heat is reproduced in the various products (of which gas constitutes 25 per cent.), whereas the thermal efficiency of an electric power station is of the order of 22 per cent.

Electrical Competition

The competitive effects of electricity are treated of in the next chapter which is devoted to the history of the gas industry. It is there stated that while the domestic consumers of the gas industry take from 60 to 70 per cent. of the output, the corresponding figure for electricity is only about 25 per cent. Gas cookers, of which there are said to be 9,000,000, are responsible for 75 per cent. of the consumption in the average household. The water heater and fire are not nearly so fully developed in spite of the potentialities.

The industrial load has increased considerably in the last few years, particularly for heat processes and for raising process steam on a relatively small scale. The gas engine is not widely used, but has special applications where the use of electric or steam power would be unsuitable or expensive.

The third chapter covers the manufacture and distribution of gas. In it the ability to store gas is emphasised as a means of levelling out the demand on the carbonising plant. Reference is made to the "service" provided by the gas industry, which makes gas (similarly to electricity) much more than a mere commodity.

The net cost of making gas (subtracting the amount realised from the sale of by-products and including capital charges) is said to be between 4½d. and 6d. a therm. Distribution, sales, service, management, etc., represent a further 2½d. to 3½d. a therm, giving a total cost to the consumer of between 6½d. and 9d. a therm. These figures lead to a mention of the two-part tariffs which have been instituted by the industry.

It is stated that on the average a gas distribution system carries only 20 per cent. or less of its capacity and that a substantial decrease in cost would occur with a greater usage by consumers.

Domestic Requirements

In Chapter IV domestic requirements are studied. It is assumed that electricity will be used for lighting, but electricity's share of the total domestic consumption of potential heat is said to be only ¾ per cent., against 7½ per cent. in the case of gas. Raw coal represents 71¾ per cent. When translated into terms of useful heat the corresponding figures are: gas, 18½ per cent.; electricity, 2½ per cent.; and coal, 52½ per cent.

The cooking load is most fully covered by gas and electricity, but for water- and space-heating probably not more than 10 per cent. or, at the most, 20 per cent. is taken by the two agents. It is held that this is a great field of possible expansion for gas.

In a section on "Competition and Price Policy," comparing various fuels, the following efficiencies are assumed: Electricity, 75 per cent.; kerosene, 60 per cent.; gas, 50 per cent.; fuel oil, 35 per cent.; anthracite, 25 per cent.; coke, 25 per cent.; raw coal, 15 per cent. It is emphasised that these efficiencies are based on evidence brought forward by the gas industry and must be taken as *ex parte*.

It is considered that electricity is dearer than gas, although its greater flexibility gives it a general advantage. For domestic heating, electricity at ½d. per unit would compete with gas at 10d. per therm.

The electricity industry is considered to have benefited by its ability to charge differential prices. The small flat-rate gas consumer is stated to benefit at the larger consumer's expense and this militates against the general adoption of two-part gas tariffs. In the case of electricity the policy of charging a high flat rate to small consumers and offering favourable tariffs to the larger ones is held to have had a favourable effect on development and to have brought down the average cost to all consumers.

The basis of domestic gas tariff structure is the cooking load, which must carry the main overheads; lower charges should thus be possible for additional demands (space and water heating). Such tariffs could take the form of a two-part rate which would strengthen the gas industry's competitive position in relation to electricity and raw coal.

Dealing with future developments, the report says that there are 11 million gas consumers and 9 million electricity consumers. The problem is to make the most economic use of both fuels. Concessionary tariffs have reduced the cost of gas to two-thirds the flat rate. At this level gas would compete on a general basis with raw coal and yet more favourably with electricity. "It should be to the consumer's advantage to use both systems of supply, the main heating load being borne by gas."

The report then goes on to make suggestions for the organisation of production and distribution, which include closer co-operation between undertakings and a considerable measure of grouping.

As to the provision of appliances, it is suggested that there should be a co-ordination of buying policy, including a move towards at least some degree of standardisation of types, the purchase of larger quantities by grouped undertakings, and communication of forward policy to makers, to enable them to plan production. The maintenance of a "healthy variety of makers' firms" is held to be desirable.

"Inadequate Sales Effort"

The gas industry is accused of inadequacy of sales effort and lack of co-ordinated commercial policy, which has resulted in the advantages of gas being inadequately presented to the public "who are apt to regard gas as an antiquated type of fuel and the local, small-town gas works as a relic of social organisation as it existed prior to the establishment of the Central Electricity Board."

An outline of commercial policy is presented, including the establishment of a central organisation for study and promoting such a policy; greater use of the Press and strengthening of relations with other industries and professions; co-operation of local undertakings in definite sales campaigns; and the maintenance of contact by local groups with local needs. A higher standard of personnel is called for, together with an extension of training schemes.

It is proposed that a National Gas Authority should be set up by the industry itself to be responsible for the development of the industry, while the present Government control should be modernised and transferred from the Board of Trade to Gas Commissioners on the general lines of the Electricity Commissioners.

The report is well worth study by all interested in electrical development. It contains lessons for them as well as affording an indication of the way in which the gas industry is likely to strengthen itself in the near future.

Portable Fuse and Plug Boxes

ONE of the first subjects which was considered by the Cinematograph Industry Committee for Standardisation was that of the electrical equipment used in studios. B.S. No. 828 for portable fuse and plug boxes which has just been issued is the first of the series of specifications which is being prepared. It points out that in a box provided with fuses of a suitable size for use with inch plugs adequate protection would not be provided in the case of a circuit connected to the box by means of a half-inch plug. For this reason it is laid down that when half-inch plugs are used they should be of a design which allows a suitable fuse to be incorporated in the plug itself.

Three sizes of box have been standardised, having two, four and six outlets, respectively. The details of the construction of the box are laid down and the temperature rise specified not only for use in film studios, but for electric lighting on stages, music halls and other similar places of entertainment. Copies of this specification can be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

INSTALMENT SALES

The Hire-purchase "Fiction"

By E. P. Hollis, B.Sc.

IN the ELECTRICAL REVIEW of January 6th, 1939, Mr. E. C. Mekie made an important contribution to the discussions on the manner in which instalment sales are to be conducted in the future, and his courage in putting into operation an agreement which differs materially from the majority of those in extensive use is to be highly commended.

To my mind the future of hire-purchase trading depends for its success upon a complete abandonment of the Helby *v.* Matthews form of agreement, which has done so much to give hire-purchase a bad name, and the adoption of the far more equitable McEntire *v.* Crossley form in one or other of the variations upon it which are possible.

The position to-day is that the expression "hire-purchase" is merely descriptive and not a phrase of legal accuracy. The goal aimed at under the system can be reached not only by using a hiring-with-option-to-purchase agreement, but by agreements taking other forms.

Looking back into history greatly assists in understanding the position. The years 1890 to 1895 were critical times for hire-purchase. In 1892, hire-purchase had a nasty setback in the Lee *v.* Butler decision, and traders devised new forms of agreements. Of these, two were approved by the House of Lords in 1895. But one fact has been lost sight of, namely, that in 1893, before these agreements were approved by the House of Lords, but after they were drafted, the Sale of Goods Act appeared. Had this Act been in existence at the time these two agreements were drafted in 1892, there might have been no such thing as hire-purchase to-day. It would probably be treated here, as it is in the United States, and as what it really is—a conditional sale.

The author commends the form of agreement recently put forward by Mr. E. C. Mekie in the ELECTRICAL REVIEW but maintains that the Electricity Supply Acts "have nothing to do with the case"

It is a curious thing that while the Sale of Goods Act (which is the soundest piece of commercial legislation upon the Statute Book) offers a clear-cut method of supplying goods under the hire-purchase system, no one has endeavoured to utilise it as a source of an agreement.

The trouble is that the adoption of the Helby *v.* Matthews agreement (for reasons which were purely fortuitous and not based on merit) to the general exclusion of other forms (remembering that there is no text book which reprints the McEntire *v.* Crossley agreement) has created a feeling in the hire-purchase industry that the fiction of hiring on which it is based is a reality. The Act has fastened Helby *v.* Matthews not only round the neck of the hire-purchase industry but of the customers, who are now condemned (except those dealing with enlightened traders) to the injustices of the depreciation clause.

Agreements to Sell

There is now the additional duty of dispelling the impression possessed by most that under a credit sale agreement the property essentially passes upon delivery. It is quite clear from the Sale of Goods Act that a contract of sale may be absolute or conditional (Section 1 (2)); that where the transfer of the property in the goods is to take place at a future time or subject to some condition thereafter to be fulfilled, the contract is called "an agreement to sell" (Section 1 (3)); and that the property in the goods is transferred to the buyer at such time and under such conditions as the parties to the contract intend it to be transferred. (Section 17 (1), &c.).

It is clear that any agreement to sell (with no hiring) on the terms that the property is to pass subject to future conditions may be what the Act calls a "credit-sale agreement." There can be no foundation for a suggestion that an agreement built up on the solid foundations of the Sale of Goods Act can be construed as a hire-purchase agreement, remembering that hire-purchase is a fiction and not based upon a statute like the Sale of Goods Act. The real truth is obvious; all hire-purchase is merely conditional sale in reality, and one cannot take the reality and claim it to be its fictional counterpart.

Mr. Mekie's excuses for adopting the McEntire agreement are unnecessary. In my opinion, it is the agreement of the future; it is the one which will be the salvation of hire-purchase trading. It is the only one which gives both the customer and the trader a square deal at all times.

The Helby *v.* Matthews agreement is very artificial in form. It has had to be bolstered up by addition of the notorious depreciation clause, and lately by what is probably the greatest monstrosity in commercial legislation, the installation charges section of the Hire-Purchase Act, which, in all seriousness, invites the trader to put alterations to premises, labour and electric wiring into a hire-purchase agreement.

It is unfortunate that Mr. Mekie has sought to create the impression that his agreement depends substantially for its strength against the customer upon rights conferred on undertakers by the Electric Lighting Acts. The fact is that there is nothing whatever in those Acts which affects the agreement as between the undertaker and the consumer. The provisions to which reference is made were drafted to protect an undertaker's property against the landlord and others.

The suggestion that they insert into an instalment sales agreement provisions that vary the agreement against the consumer is untenable. For, by pursuing the matter to its logical conclusion, when a consumer signs a hire-purchase agreement or a contract of absolute instalment sale he would, if Mr. Mekie's contention be accepted, be signing a contract which was not what it was represented to be, and the failure to disclose that the contract was varied by the Acts would constitute a misrepresentation entitling the consumer to a rescission of the contract. Further, existing agreements would be unenforceable for like reasons.

I trust that Mr. Mekie will agree that the agreement can be used in principle by any instalment sales trader, and that such traders will be able to derive from it all the benefits claimed, excepting those relating to distress and the like. I presume that he will know that he will be subjected to charges of "Act evading" and unfairness to the customer by those whose knowledge of hire-purchase is confined to Helby *v.* Matthews, and I hope that nothing will daunt him in pressing forward the adoption of what is the simplest and most equitable form of agreement that can be used in hire-purchase trading.

Not only should the principle of the agreement be supported by electrical undertakers, but by all electrical contractors and manufacturers who desire to adopt that form of the hire-purchase system which gives the customer the squarest (if I may use the expression) possible deal.

The Mechanism of Magnetisation

DATA supporting his previously formulated views on magnetisation are communicated by Dr. F. T. Wall to *Nature*. Following his experiments with solid-drawn steel tubes, tests have been made with solid-drawn charcoal iron tubes of various wall thicknesses and with the same solenoid as before.

Plotting magnetic force (H) against exciting amperes shows that the reduction in the value of H inside the tube increases with the thickness of the wall, that the reduction of H is a maximum when the tube is magnetised to a condition approximately corresponding to the knee of the magnetisation curve and that when the tube is magnetised to a condition of saturation the value of H within the tube is practically unaffected by the material of the latter.

The self-demagnetising effect of the ends of each tube is also shown to be negligible. The conclusion is drawn that these results confirm Dr. Wall's theory that the magnetisation of a material is initiated at the surface and proceeds inwards by a kind of chain effect so that the flux density near the surface is a maximum and becomes progressively less as the distance from the surface increases.

E.I.B.A. Rules Amendment

WITH a view to giving the Council of the Electrical Industries Benevolent Association more adequate scope in the designing of the administrative machinery necessary to carry on its routine work, a proposal to amend the rules of the Association will be brought before an extraordinary general meeting to be held immediately after the annual general meeting called for noon on April 21st, at the Savoy Hotel, London, W.C.2.

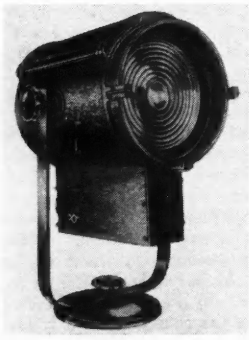
The need for the proposed changes, which will bring the E.I.B.A. rules into line with more modern practice, has been emphasised by the rapid growth of the Association's work in the last two years.

NEW ELECTRICAL PRODUCTS

A review of equipment recently marketed

Lighting Units

HOLOPHANE, LTD., Elverton Street, Vincent Square, London, S.W.1, has produced a new blue prismatic glass, called the "Correctalite," made from a special composition which acts on the red and yellow rays of gasfilled filament lamps to produce illumination approximating to daylight.



Holophane "Frenca" spotlight

This new type of reflector has been evolved as the result of the experience gained with the "Correctalite" bowl, a totally enclosed unit containing a deep, blue, bell-shaped skirt surrounding the lamp. The aim is to give an approximate daylight effect from gasfilled lamps without the high absorption of true daylight matching units.

A new high-intensity spotlight called the "Frenca" has just been placed on the market. The unit is designed to take lamps of from 500 to 2,000 W for stage work.

A highly concentrated beam is obtained by means of a circular prismatic lens, the size of spot, which has a soft edge, being easily adjusted by means of a single knob control. Remote solenoid control of colour screens is fitted on the *de luxe* model, but the cheaper one has hand-operated colour change. The casing is of aluminium alloy with sheet steel baffles mounted on an adjustable trunnion with heavy cast base plate.

Welding Generator Sets

Since the introduction of the "KS" welding generator by LAURENCE, SCOTT & ELECTROMOTORS, Ltd., Norwich, about eighteen months ago, a large number of special sets has been made in addition to the comprehensive range of standard motor- and engine-driven sets, including petrol and Diesel engine-driven equipment made to individual requirements.

One is a trailer-type portable welding set which can be towed behind a lorry or private car. In its design special attention has been paid to the stability of the trailer, the centre of gravity being exceptionally low while the wheel track is 4 ft. 6 in.

The welding generator is one of the "KS" Series 20 type with a maximum intermittent welding current of 300 A, a portable regulator giving control from 12-300 A; this regulator can be detached and carried to the position of welding when the job is inaccessible.

The petrol engine was made by the Austin Motor Co., and the trailer unit was supplied by Dixon-Bate, and incorporates their automatic brake and hand lever, rubber-lined coupling and four corner stands (the front two with screw adjustment). The generator shaft extension is used for driving a portable grinder, drilling machine or any other accessory required. Provision is made for storing accessories, cable and tools when not in use, and the set is supplied with removable sidescreens.

Similar welding sets were recently supplied to a Dominion Government, but in this case the driving unit consisted of a Perkins "Wolf" Diesel engine; the welding generator was fitted with an AC motor and starter and was coupled to the Diesel engine by means of a claw clutch, so that when in use in the workshop the set could be driven from electricity mains. The welding set was built as a unit complete with bedplate, canopy and sidescreens and could be removed as a unit from the trailer.

Another adaptable set comprised a petrol engine driving a "KS" series 20 welding generator. From the extended pulley of the latter an air compressor and a fan for its radiator were driven, and an air receiver was mounted alongside the engine. This provided a very useful supply for arc welding and for pneumatic riveting and caulking tools.

"Oscillith" Pushes

The "Oscillith" bush is a development by WILMOT-BREEDEN, LTD., Eastern Works, Camden Street, Birmingham, 1.

It consists of a cushion made of a casing of rubber, which may be distorted but not compressed, with a spiral spring incorporated. The casing, when subject to an axial pressure tending to force the ends together, forms a series of regular flanges, internally and externally, without any variation of its volume. It returns to its original dimensions when relieved of the pressure placed on its ends.

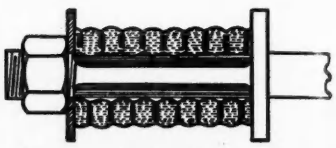


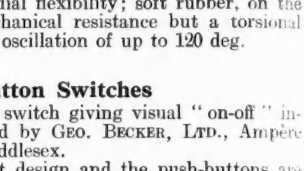
Diagram showing how axial pressure produces flanges

The bush, if demounted, can be used again. It can also be used on parts not machined and there is no necessity for precision in the parts with which it is to be used. It is an electrical insulator and various qualities of rubber in conjunction with springs of varying rigidity enable joints to be produced giving different degrees of flexibility. Hard rubber gives high mechanical resistance but decreased radial flexibility; soft rubber, on the other hand, gives less mechanical resistance but a torsional flexibility with an angle of oscillation of up to 120 deg.

Push-button Switches

A sunk type push-button switch giving visual "on-off" indication has been developed by GEO. BECKER, LTD., Ampère Works, Wembley Park, Middlesex.

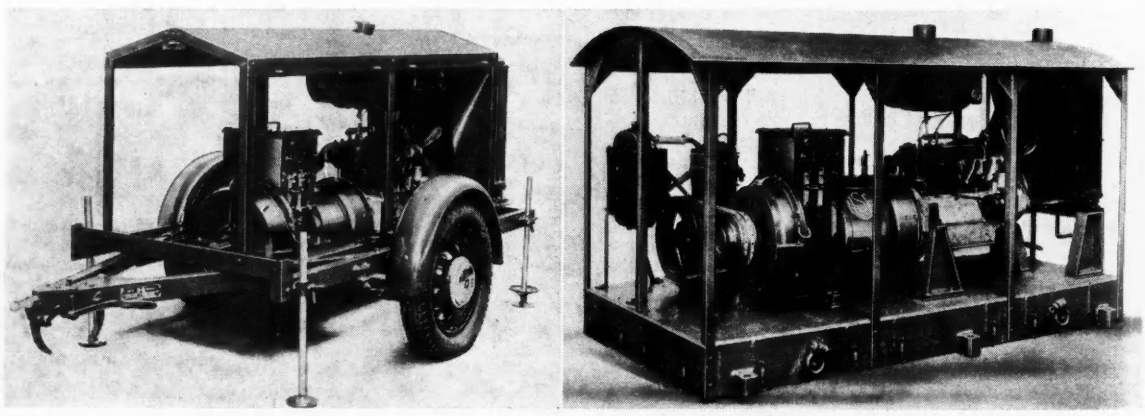
The large plate is of neat design and the push-buttons are red and black mouldings, one appearing automatically as the other is pushed in. The switch is of the quick-break type with a positive action and phosphor-bronze contacts.



Becker push-button switch

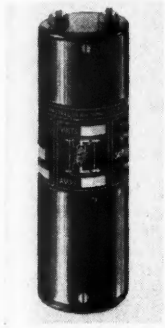
The switch is supplied as a complete unit, which can be wired and fixed without the plate being removed from the porcelain vitreous base. Terminal cut-outs make for speedy wiring and the unusual claw device secures the switch firmly in position by the mere tightening of the screws on the plate. This action forces the claws outwards and gives a firm hold upon the sides of the box.

The switch is available white or coloured in one- and two-way forms singly or with a two-hole plate to accommodate two switches.



New Laurence, Scott welding generators: "KS" welder driven by a petrol engine on a special trailer and engine-driven "KS" welder with air compressor

Midget Relays



Sordoviso "Midget" relay

The demand for relays and contactors which occupy a minimum of space has led SORDOVISO SWITCHGEAR, LTD., 220, The Vale, London, N.W.11, to standardise a new range of "Midget" relays. These small units, which can be supplied for controlling up to 20 A at 230 V, are only 1½ in. in dia. and from 3 to 5 in. long according to the rating. The standard unit is completely enclosed in a metal case and can be fitted with terminals or insulated leads as required.

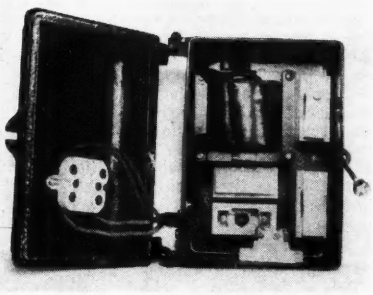
Producing AC from Batteries

In our last week's issue we stated that the "Rotaceptor" produced a frequency of from 800 to 3,000 cycles per sec. This should read revs. per minute, giving a frequency of up to 500 cycles per sec.

A Low-voltage Transformer

A low-voltage transformer suitable for stepping-down 250 V to 12, 25 or 50 V with an output of up to 50 W is the latest product of the PIGGOTT ELECTRICAL CO., Salisbury Square House, E.C.4.

It is of orthodox design with 5-A plug-in fuses on each pole of both primary and secondary, while switching is effected by a 5-A tumbler switch mounted on the lid. No mechanical interlocking is provided on the lid. The illustration shows the transformer unit with one of the fuses removed.



Piggott fused transformer

High-rupturing-capacity Fuses

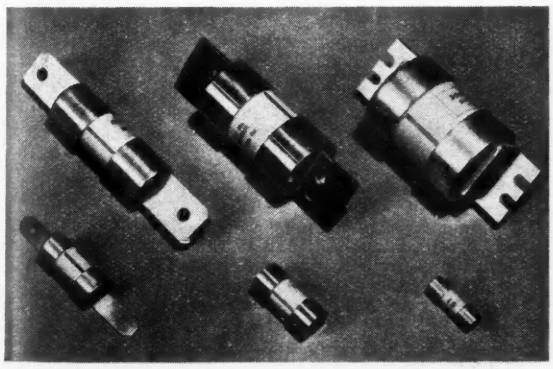
To render existing switch-fuse gear capable of dealing with higher fault kVA, LAWSON BECK, LTD., Queensway, Team Valley Trading Estate, Gateshead-on-Tyne, have introduced a high-rupturing-capacity non-deteriorating cartridge fuse-link for short-circuit protection.

What is said to be a new form of fuse element is employed, having special time-lag characteristics designed to withstand severe motor starting currents, whilst affording overcurrent protection to cables. This permits the fuses to be marked according to the horse-power of the motor for which they are suitable. The elements are contained in a ceramic body and surrounded with graded chemically inert silica as the arc-quenching medium.

A "safety indicator" comprises an alloy wire totally enclosed in a white translucent sleeving and fitted in a separate slot on the side of the cartridge which turns black when the fuse-link blows. Tests have shown this to be quite safe in an explosive atmosphere.

All ratings comply with B.S.S. 88-1937 regarding breaking capacity, fusing factor and temperature rise. The breaking capacity is said to be over 25,000 kVA and the fusing factor 1.4.

The design enables these fuses to be used in series with close ratings of either semi-enclosed copper wire or cartridge type fuses to provide discrimination or predetermined fusing in sequence.



Lawson Beck cartridge fuse links with various types of end contacts and showing safety indicator before and after operation

Ultra-violet Ray Photometer

What is claimed to be the only instantaneous direct-reading photometer yet available for the measurement of ultra-violet rays should prove of particular value for medical and industrial purposes.

This ingenious instrument, which is made by HENRY ALLDAY & SON (1922), LTD., 19-21, Warstone Lane, Birmingham, in several types, consists essentially of an indicating movement and a composite unit comprising three or more filters, fluorescent material and a photo-electric cell. Several cell units with different characteristics can be incorporated to restrict the wavebands measured, this feature being especially useful for certain classes of industrial work.

For industrial purposes it is calibrated generally in micro-watts per sq. cm., while for medical use it can be arranged to indicate the correct dosage of treatment in minutes. Incidentally, when employed by a radiologist it often enables the number of treatments required to be substantially reduced, since much preliminary experimental dosage can be eliminated. Moreover, used intelligently, any risk of burning can be eliminated. One type of instrument is applicable to u.v. ray measurement in theatre stage lighting schemes.

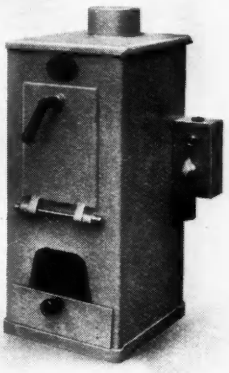
The instrument is British made throughout, and is exceptionally light and easily portable. It weighs only 9 oz., and measures 4 in. by 1½ in. by 2¾ in.

Electric Incinerator

An electric incinerator introduced by ARCHIBALD LOW ELECTRICS, LTD., Newarthill, Motherwell, Lanarkshire, is specially suitable for destroying small dressings and bandages in hospitals, nursing homes and first-aid centres.

It is constructed of sheet-steel and cast-iron, with the interior brick lined. The 2-kW heating elements, which are controlled by a three-heat switch with indicating pilot lamp, are arranged so as to dispose of the contents rapidly. A fume outlet is provided at the top of the incinerator.

As an alternative to the three-heat switch a timing device graduated up to 30 min. can be fitted. Two models are available for floor and wall mounting.



"Highlow" incinerator

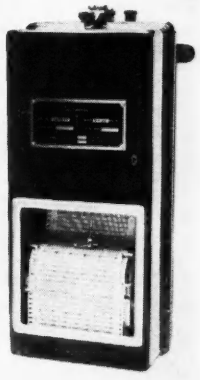
Rectifier Type Recording Instruments

A series of rectifier type recording ammeters and voltmeters has lately been brought out by ELLIOTT BROTHERS (LONDON), LTD., Century Works, Lewisham, London, S.E.13.

These instruments are intended primarily for use on AC circuits at all normal frequencies and employ a standard DC moving-coil recorder movement together with a "Westinghouse" copper-oxide full-wave rectifier fed through a small current transformer. The instruments have a small power consumption (1 VA), linear scales, small frequency error and a low temperature co-efficient.

The sensitivity of the zero voltmeters of this type is stated to be about 100 ohms per volt and that of potential indicators 40 ohms per volt.

The instruments can be specially arranged to record both AC and DC. Ammeters are self-contained in ratings of up to 100 A. The dimensions are 19 in. high by 8.75 in. wide with a 7.75 in. projection.



Elliott rectifier instrument

Poison Gas Filtration Plant

Several interesting features are embodied in the latest poison gas filtration plant of OZONAIR, LTD., Longmoore Street, London, S.W.1, which is being made to Government specification.

The air is first drawn through filters where it is freed of all ordinary dirt and smoke so that the special gas filters shall not become choked with ordinary impurities. When gas filtration is not necessary the air is by-passed by means of a special valve.

The gas absorption filters of the plant are composed of cartridges, each of which is standardised to pass up to 5 cu. ft. of air per minute, enough for two persons. Duplex filters are fitted so that by means of a change-over valve a new set of filters can be brought into use immediately.

The drive is by an electric motor of 0.2 to 1 HP for 8 to 100 persons, respectively. For the smaller sizes manual emergency drive is also provided.

NEW BOOKS

Installation Work. Lift Design. Demonstration Models

Electrical Installations. By J. W. SIMS. (Pp. 119; figs. 110.) John Murray, Albemarle Street, London, W.1. Price 6s.

WHILE great care is exercised in the design and manufacture of electrical equipment the men responsible for its installation often show a woeful lack of knowledge of the conditions governing its operation. The result is that trouble soon develops, the blame for which is laid against the equipment itself. This is particularly the case with the installation of domestic equipment and the wiring of small houses.

There is, however, no valid excuse for such a state of affairs, since examinations are held for electricians' and electricians' extra certificates, and the holding of these or something of an equivalent standard should be regarded as an essential qualification for those responsible for carrying out work of this description.

The author of this little book has dealt in a very simple and straightforward manner with the theoretical side of the syllabus recommended by the advisory committee on electrical installations formed jointly by the Electrical Contractors' Association and the City and Guilds of London Institute, and it is suggested that this part of the subject is essential to a realisation of the importance of the regulations laid down by the Institution of Electrical Engineers, the fire insurance companies and the Home Office. This includes a knowledge of the units used in electrical measurements, calculation of resistance—including insulation resistance—heating effect, illumination and so on, and of the various meters used in this work.

The different systems of lighting and heating are described as well as the types of switches, fuses and earthing devices employed, and there is a small section dealing with tariffs. In addition, a number of simple calculations have been included where necessary, together with tables of valuable data which, with the comprehensive index, add considerably to its usefulness. We can recommend this book to all who are connected with the installation side of the electrical industry.—A. R.

Electric Lifts. By R. S. PHILLIPS. (Pp. 284; figs. 191.) Sir Isaac Pitman & Sons, Parker Street, Kingsway, London, W.C.2. Price 20s.

This is the first comprehensive work on the subject published in England since Grierson's book appeared in 1923, and its pages are full of reminders of the advances made since then. The author saves us a historical section, and plunges directly into a record of current practice in layout, construction, operation and maintenance.

All classes, sizes and speeds of lifts are dealt with. Alternative designs of the various components are lucidly described and illustrated, the detail drawings and diagrams being exceptionally clear. The chapter dealing with controllers would perhaps have been more useful if, in addition to describing first-class practice, it had pointed out some of the many snags which dog the steps of the designer. The author, perhaps wisely, refrains from drawing upon his great experience to express opinion upon debatable points; instead he places the pros and cons before the reader and reserves judgment.

An excellent chapter deals with lift motors, and another admirably describes variable-voltage equipment. Brakes, gearing, vars, counterweights, guides, gates, doors and indicators are all adequately dealt with, as are systems of floor levelling. Much is said about safety features, but the subject is so wide that a good deal is left unsaid. The section dealing with maintenance and testing is helpful, but not exhaustive, and the important work of fault-finding, which occupies so much of a maintenance engineer's time, is almost entirely neglected. Appendices deal with Section 22 of the Factory Act, 1937, and contain a number of useful tables.

This book will be helpful to engineers engaged in the design, specification or maintenance of electric lifts, and to those who have to adapt old lifts to conform with the new Factory Act requirements.—H. M.

How to Make Working Diagram Models Illustrating Electrical Principles. By H. R. LANGMAN. (Pp. 78. Illus.) The Technical Press Ltd., 5, Ave Maria Lane, London, E.C.4. Price 3s. 6d.

Educational authorities always lay particular stress upon the value of experimental work as a means of impressing on the mind of the student the true meaning of the various principles dealt with in the class. Even if the student cannot carry out the various experiments himself it is a very great help if he has the opportunity of witnessing demonstrations by his teacher.

The only hindrance to the general adoption of the demonstration method of teaching is the difficulty of obtaining the often expensive equipment, but the author of the book under review, by the use of what he terms the "diagram model," shows how this obstacle can to some extent be overcome. His method certainly assists very greatly the understanding of the fundamental principles involved. The models described are of the uniplanar type and can be constructed of cardboard—although for great permanence the use of plywood, or even sheet metal, is recommended—and by the cutting of slots and the use of sliding or rotating members the conditions at the different stages of the cycle of operations are demonstrated.

With a little skill in cutting, combined with the ability to draw, these models can be given a very workmanlike appearance, and having made those described, the production of others should become a simple matter. We can recommend this book both to the student and also the teacher of electrical engineering, as the latter by the choice of a suitable scale should be able to produce models which will greatly assist him in his lectures.—A. R.

Transient Electric Phenomena. By THOS. WATERHOUSE. (Pp. 80; figs. 40.) Draughtsman Publishing Co., Ltd., 96, St. George's Square, London, S.W.1. Price 4s.

This latest addition to the long list of technical pamphlets published by the Association of Engineering and Shipbuilding Draughtsmen, though somewhat mathematical, is likely to be widely appreciated. The author deals with transients produced by the sudden closing and short-circuiting of various electrical circuits and apparatus and, in general, his procedure is to establish the voltage equation of the circuit and solve it in order to find the current. From this the energy stored in the circuit and the voltage across the various components are deduced in the simpler cases. Transient effects are differentiated according to whether they occur in space (travelling waves) or in time, and the difference between single and double energy varieties is made clear.—W. O. F.

The Engineers' Who's Who. (Pp. 734.) Day & Company, "Glenwood," Dorking. Price 20s.

This second edition, which has been compiled with the co-operation of the leading professional Institutions, records the names of nearly 7,000 British engineers, who for the most part are actively engaged in work in the United Kingdom. A new feature is age or date of birth, and full and verified titles, addresses, and appointments are given throughout. The new edition contains more than five times the number of biographies given in the first volume.

Parliamentary News

(BY OUR SPECIAL REPORTER)

Electricity in Mines

IN the House of Commons on March 21st, during a debate on safety in mines, Mr. Grenfell, referring to the recent report of the Royal Commission on this subject, said that if the kind of ventilation foreshadowed in the report was made the rule in the mines of this country there would not be much danger from the use of electricity.

Mr. Hopkinson said that electricity was being used at the coal face in some cases where its use, to say the least, was undesirable. Mechanisation of every sort had been overdone.

Mr. T. Smith declared that he would like to see the use of electricity at the coal face reduced to the absolute minimum.

Mr. Cross, Parliamentary Secretary to the Board of Trade, said that a departmental committee of electrical engineers, under the chairmanship of Professor W. Cramp, had been set up and would hold its first meeting on March 31st.

Special Orders

On March 22nd Sir J. Nall asked the Minister of Transport how many applications for Special Orders under the Electricity Supply Act, 1919, were made in the years 1936, 1937 and 1938 respectively; and how many in each case were still under consideration.

Mr. Burgin said that the number of applications for Special Orders, excluding applications by the Central Electricity Board, in the years 1936, 1937 and 1938 respectively was 9, 12 and 3. Six were still outstanding and of these one Order was now before Parliament, three were awaiting confirmation by him and two were under consideration.

Pocket Wireless for Police

On March 23rd Mr. Day asked the Home Secretary whether, in view of the various instances of great service derived by the use of pocket wireless by provincial police forces, he was considering the use of this apparatus in the suburban districts of the Metropolitan police area.

Mr. Lloyd said that the Commissioner of Police was watching closely the development of pocket and other small portable wireless apparatus but at the present stage of development the equipment available could not be effectively used for police purposes in the Metropolitan police district.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

AT the annual dinner of the West Wales branch of the Association of Mining Electrical Engineers, which was held in Swansea on March 18th, Dr. A. A. Fordham, of Swansea University College, said that it must have been of considerable satisfaction to them that the Royal Commission on Safety in Mines should suggest that their certificate examination should be recognised in place of the State examination if compulsory certification of mining electrical engineers became law. Mr. S. B. Haslam said that compulsory certification was bound to come for the mechanical as well as the electrical worker in the mines, and the Association had not decided to admit the mechanical men. He expressed the Association's satisfaction at Government recognition of its status. It now had a membership of 2,900.

Mr. N. Hunter, borough electrical engineer at Morley, has been appointed borough electrical engineer at Barnstaple at a salary of £600. He served his apprenticeship with A. Reyrolle & Co., Ltd., and received his technical training at Armstrong College, Newcastle-upon-Tyne. He has held various positions with the South Shields and Newark Corporations, the Yorkshire Electric Power Co., and the Sheerness & District Electricity Supply Co., and was deputy borough electrical engineer at Whitehaven before being appointed borough electrical engineer at Morley. Mr. Hunter is an associate member of the I.E.E., and is also a member of the Transmission Section.

Mr. N. Hunter

The staff of the Leicester Corporation Electricity Department and friends numbering 650 attended the Department's fifth annual staff dance at the Palais de Danse on March 24th. Among those present were Mr. J. Mould (chief engineer and manager), Mr. D. H. Parry (deputy engineer), Coun. J. Minto (chairman of the Electricity Committee), Coun. J. F. Wale (vice-chairman), and Mr. H. Jantzen (constructional engineer).

That electrical contractors should be registered was emphasised in the speeches at the annual dinner of the Liverpool Branch of the Electrical Contractors' Association, held on March 15th. Mr. P. J. Robinson, the city electrical engineer, said that the old adage "The customer is always right," applied in the electrical industry as in others. Although the Liverpool Corporation carried out a lot of wiring work itself, it had always been ready to give contractors work to do, and it was one of the first authorities to give all its own work to registered contractors. Mr. L. C. Penwill (director and secretary of E.C.A.) said it was in the public as well as in the trade interest that contractors and operatives should be licensed, in order that a high standard of workmanship could be maintained and guaranteed. **Mr. R. Harrison Watson** presided.

Mr. R. B. Nash has been appointed chairman and **Mr. B. H. Lambert** vice-chairman of the newly formed Liverpool and District Branch of the Association of Supervising Electrical Engineers. The hon. secretary is Mr. J. L. Gower, 244, Brodie Avenue, Mossley Hill, Liverpool, and the assistant secretary is Mr. W. A. Sloane.

Mr. A. W. Evans, technical engineer in the Mains Department at the head office of the County of London Electric Supply Co., Ltd., who was recently appointed an Electrical Inspector of Factories, has been presented with a grandmother chiming clock by the engineering staff of "Clesco." The presentation was made by Mr. H. C. Wells, mains engineer, who paid tribute to Mr. Evans's efficiency and popularity during his nine years' service with the County Co.

Mr. R. Robinson, secretary of the Newcastle and District Electric Lighting Co., Gateshead, is to retire shortly after twenty-six years' service.

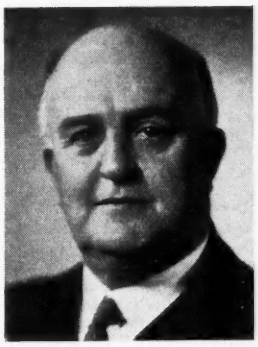
Dr. G. W. C. Kaye, superintendent of the Physics Department, National Physical Laboratory, has been elected a Fellow of the Royal Society.

Sir Andrew Duncan, LL.B. (Glasgow), has had the degree of LL.D. conferred on him by the Senate of the University of Glasgow.

Mr. R. E. Rogers, deputy city lighting engineer with the Liverpool Corporation, will retire in July after serving for forty-six years in the Liverpool City Lighting Engineer's Department. Mr. Rogers entered the service of the Corporation as a junior clerk in 1893 and has been deputy engineer since July, 1930.

Mr. C. Binns, deputy electrical engineer of Kettering Corporation Electricity Department, was married at Kettering on March 23rd to Miss Vera Munn, a secretary at the Electricity Department offices. The presents included a silver teapot from the Electricity Department staff at Kettering, Market Harborough and Corby, and a cut-glass fruit bowl and sweet dish from the jointers, mates and gang of the mains department.

Mr. E. Gomersall, O.B.E., is retiring from his position as Regional Director, London Telecommunications Region, on March 31st, after forty-eight years' service. After serving as a telegraphist in Leeds Post Office he was transferred to the Engineering Department and came to London in 1898. As engineer, technical officer, and staff engineer successively, he was chiefly engaged on the design and construction of external telephone plant. In 1909 he became assistant superintending engineer in the South Metropolitan District and was in charge of that district in 1912 when the National Telephone Co.'s system was taken over and when the Epsom automatic exchange was opened, the first in Great Britain. Subsequently he was engaged at Reading in setting up the new South Midland District, in 1915 he became superintending engineer in Ireland, in 1919 superintending engineer in the North Midland District and in 1928 he returned to London as deputy superintending engineer and was appointed superintending engineer, London, in 1929. In 1936 he was appointed Regional Director and undertook the task of bringing the telephone and telegraph work in the London Region under one control, including traffic and sales, engineering, accounts, and staff and buildings. He has always taken a special interest in the sports and social activities of his staff and the Sports Association which he initiated in 1931 has over 8,000 members.



[Elliott & Fry, Ltd.

Mr. E. Gomersall

Mr. H. F. Hudson (president) presided on Wednesday night at the annual dinner and dance of the Midland Division of the Electrical Power Engineers' Association at the Botanical Gardens, Edgbaston. Mr. C. M. Shaw (chief engineer and manager, Worcester Electric Supply Department), proposing the toast of "The Association," said that its educational work, particularly on the technical side, was of the greatest value; and it had done capital work in settling troubles between managements and staffs. **Mr. P. S. Jolin** (president of the E.P.E.A.), in responding, pointed out that it was no longer necessary for the Association to threaten to take strike action. That was due to the existence of the Whitley Council, which rendered excellent service to the industry. The Association had brought into the industry the right kind of man required for the work. The toast of "The Ladies" was proposed by Mr. H. Hooper (past chairman, South Midland Centre, Institution of Electrical Engineers) and Mrs. H. S. Davidson replied. Mr. H. J. Cox (Birmingham) submitted the toast "The Chairman and Mrs. Hudson."

Ten years ago the Association of Ex-Siemens Men was formed, and although the ranks have been depleted with the passing of time, there is still a close bond of comradeship between those that remain. This was exemplified on Friday last, when members gathered together for their tenth annual smoking concert, and under the genial chairmanship of Mr. J. W. Brookes the evening passed in pleasant companionship. The business part of the evening was disposed of with commendable speed, the election of new committee members and the re-election of other officers being carried without dissent. A message was received from Mr. J. Snow Huddleston, the president, who was in the North, expressing his regret at being unable to attend. Mr. P. C. Pope, the hon. treasurer, referred to the Association's benevolent fund for assisting members in time of need, and a collection made during the evening considerably augmented this.

[Vandyk

Major A. L. Trundle who, as we recently reported, is the new chairman of the Electric Vehicle Association

This year the London Students' Section of the Institution of Electrical Engineers held a combined dinner and dance instead of two separate functions. Over 200 attended, and the Lysbeth Hall, Soho Square, provided an attractive rendezvous for the gathering last Friday. **Mr. P. H. Pettifor** took the chair, and proposed the toast of "The Institution," paying tribute to the members who had helped in the work of the Student Section—notably Mr. Whipple, Dr. Fleming and Mr. Harris. Dr. A. P. M. Fleming (President of the Institution), in responding, referred to the difficulties which young engineers experienced. He advised them to go on studying—it paid in the long run. Mr. G. N. Preston, the entertainments secretary, proposed the toast of "The Guests," the reply being made by Mr. G. A. Whipple. Mr. A. H. Young, the secretary, told us that the membership was now 2,055, an increase of a hundred over last year. Incidentally, the London Section is this year running the students' summer tour which will be to S.W. France.

No fewer than sixty-four prizes were contributed for the second annual electrical carnival ball held at the Coronation Suite, Belle Vue, Manchester, on March 23rd. Proceeds of the event, which was supported by all sections of the electrical industry, will be given to the E.I.B.A. All programmes were numbered. Some of them bore lucky numbers which entitled the holders to a prize voucher. During the evening there was a draw for a Hanovia "Homesun" lamp, a Hotpoint vacuum cleaner, and a Hoover "Dustette." An interesting feature of the evening's entertainment was a series of treasure dances held at forty-minute intervals. Two prizes were awarded for each dance. Donors of prizes were nearly all companies in the electrical industry.

Mr. W. R. Preston, late of Drake & Gorham, Ltd., Manchester, has joined the staff of Thomas Wood & Son (Chester), Ltd.

The Century Players of Elliott Bros. (London), Ltd., presented a well-produced and attractively staged variety show, "Fanfare," on March 16th, 17th and 18th. The programme included some first-class talent provided by employees, with one guest artist who coached the "Century Eight" in tap dancing. The Mayor and Mayoress of Lewisham were present on one of the evenings and for three nights the hall was filled. The show was written and produced by Norman Chalfont, who also composed some of the musical numbers and conducted the variety orchestra.

Mr. H. C. Babb, general manager of the Lothians Electric Power Co. and the Musselburgh Electric Light & Traction Co., has been appointed chairman of the Scottish Area Committee of E.D.A.

Mr. B. Welbourn, M.I.E.E., and **Mr. C. Heathcock** have been elected directors of the Midland Electric Corporation for Power Distribution, Ltd. Mr. Heathcock has been in the service of the company in various capacities for thirty years, and during the last five years as manager.

On March 23rd, in Henley's Social Club Room at Holborn Viaduct, Sir Montague Hughman made a presentation of a grandmother clock to **Mr. T. J. Hudson** on behalf of his many friends on the Henley staff, to mark his retirement after thirty-three years in Henley's service—with a silver tea service for Mrs. Hudson. Mr. Hudson started with the company as South Coast traveller and has spent the past eight years as Brighton branch manager. Mr. W. F. Bishop said that Mr. Hudson was probably one of the oldest men in the cable industry. Mr. Hudson suitably replied.

There was a large gathering at the Grand Hotel, Glasgow, on March 27th, to mark the fiftieth anniversary of Holland House Electrical Co., Ltd. A whist drive, dinner and dance were held during the evening and at the dinner **Mr. H. Watson,** A.M.I.E.E., one of the pioneers of the company, gave an outline of its history. A telegram was read from Mr. Glenister (director) who was engaged entertaining another section of the staff at a theatre.

Major W. Roberts, A.M.I.E.E., who since 1919 has been in charge of the Cardiff office of the Electrical Apparatus Co., Ltd., and for the last four years has also been joint sales manager, is relinquishing both appointments and resigning from the service of the company as from April 15th.

Mr. C. S. Franklin, of Marconi's Wireless Telegraph Co., Ltd., retired on March 23rd on attaining his sixtieth birthday. Mr. Franklin was the creator of the method of directional wireless telegraphy which is known as the Marconi beam system. His achievements are commemorated on a granite column erected two years ago by the Marconi Co., at Poldhu near the site of the Poldhu wireless station.

OBITUARY

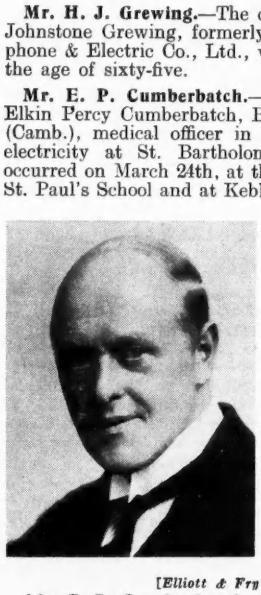
Mr. H. C. Walker.—The death occurred on March 25th, at the age of eighty-seven, of Mr. Henry Claude Walker, who was chairman of Waygood-Otis, Ltd., until his retirement in 1934. He was also a director of several electricity companies. At the age of fifteen Mr. Walker joined the engineering business of Richard Waygood and three years later he took what is believed to be the first order for an hydraulic lift, the construction and success of which laid the foundation of the Waygood lift business. At the age of twenty-one he became partner in the firm of R. Waygood & Co., and chairman and managing director of the business when it was converted into a public company in 1900. He visited the United States in 1879 to study the development of lifting apparatus by Otis Brothers, and this led to the ultimate amalgamation of the two businesses known to-day as Waygood-Otis, Ltd. He was a member of the Institutions of Mechanical and Civil Engineers.

Mr. G. E. Riley.—It is with regret that we announce the death on March 21st of Mr. George E. Riley, A.M.I.E.E., manager of the Switchgear Sales Department of the British Thomson-Houston Co., Ltd., Willesden, at the age of fifty-nine, following a short illness. Born and educated in Cambridge, Mr. Riley received his technical training at the Crystal Palace School of Engineering, after which he spent a short period with Geo. Richards & Co., Ltd., machine tool manufacturers, of Broadheath, Manchester. He joined the B.T.H. Co. at its headquarters in Cannon Street in 1899, leaving shortly after the turn of the century to spend about a year with the A.E.G. in Berlin. On returning to England he was associated with Crompton & Co., Chelmsford, for a few years. In January, 1906, he rejoined the B.T.H. Co. at Rugby and in 1909 was appointed to the contract department, being made manager of the switchgear section in 1917. He became manager of the switchgear sales department when the sales organisation was transferred to the company's Willesden Works in 1926, a post which he held until his death. For nearly twenty-five years Mr. Riley was associated with the British Electrical and Allied Manufacturers' Association. He was largely responsible for the important position that switchgear manufacture now occupies, for his wise guiding influence contributed much to that achievement. His name will also be associated with the latest experiment in electrical co-operation—the Association of Short-circuit Testing Authorities (A.S.T.A.). We extend our sympathy to Mrs. Riley in her sad loss.

[*Elliott & Fry*
The late Mr. G. E. Riley

Mr. H. J. Grewing.—The death is announced of Mr. Henry Johnstone Grewing, formerly a director of the Oriental Telephone & Electric Co., Ltd., which occurred on March 17th at the age of sixty-five.

Mr. E. P. Cumberbatch.—The death is announced of Mr. Elkin Percy Cumberbatch, B.M., B.Ch.(Oxon), D.M.R. & E. (Camb.), medical officer in charge and lecturer on medical electricity at St. Bartholomew's Hospital, London, which occurred on March 24th, at the age of fifty-nine. Educated at St. Paul's School and at Keble College, Oxford, he entered St. Bartholomew's as house physician and was demonstrator of physiology in the medical school there for two years. He determined to devote himself to scientific work, beginning in the X-ray department, and he succeeded Dr. Hugh Walsham in 1912 as head of the electrical department, the name of which was changed to the electro-therapeutic department. He was president of the Section of Electro-therapeutics of the Royal Society of Medicine in 1921, president of the Section of Electrology at the Bi-Lingual Congress held in London in 1922, and president of the sixth International Congress of Physical Medicine held in London in 1936. He had contributed to the pages of the ELECTRICAL REVIEW on electro-medical subjects.



[*Elliott & Fry*
Mr. E. P. Cumberbatch

Mr. H. Petersen.—The death recently occurred in Oslo of Mr. Hermod Petersen, the Director-General of the Norwegian Telegraphs and Telephones.

Municipal Loans Sanctions

DURING the four weeks ended March 25th the Electricity Commissioners sanctioned the borrowing by public authorities (joint electricity authorities, joint electricity boards and local authorties) for electricity supply purposes of a total sum of £1,912,984, made up as follows:—Purchase of property, £2,934; generating station buildings, £105,698; distribution buildings, £8,849; generating station plant, £31,499; distribution plant, £230,910; mains extensions, house services, meters and instruments, £1,197,396; and consumers' wiring installations, consumers' electrical apparatus and other purposes, £335,698.

The total amount sanctioned for the period from April 1st, 1938, to March 25th, 1939, was £23,928,940, which compares with £18,673,900 for the previous comparable period.

COMMERCIAL AND INDUSTRIAL NEWS

Electrical Propaganda. Twine Factory Change-over. "Mercra" Factory Lighting. Scottish Building Exhibition. Electrical Manufacture in France.

A Laundry Lighting Installation

THE new "Saferlite" reflector, which has been produced by the Revo Electric Co., Ltd., is proving popular. This reflector has a patent device for the instantaneous release of the reflector, together with the lamp, and a number of these installations are being completed each week. An excellent example is the installation at the new laundry of the C.W.S., Ltd., Birmingham. As our picture shows, the reflectors provide an even illumination over the entire floor surface and machinery.

Revo "Saferlite" reflectors in the laundry of the C.W.S., Ltd.

New "Met-Vick" Calendar

The 1939-40 calendar of the Metropolitan-Vickers Electrical Co., Ltd., is the twenty-fifth annual issue in the present series of "girl" calendars. "Sylvia" is an attractive brunette and a worthy upholder of the standard set by the company in this series.

Flameproof Gear Development

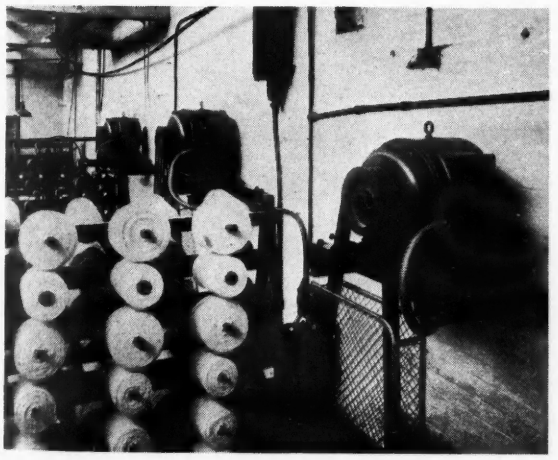
The Belmos Co. and E.M.B. Co., Ltd., have been co-operating for the past two years in the development of specialised units of flameproof gear for colliery work. To further the development and expedite the service to customers, the Belmos Co. will in future be directly responsible for the commercial side of the joint business. All inquiries for colliery control gear, including E.M.B. flameproof controllers and resistances, should be addressed direct to the Belmos Co., Motherwell Road, Bellshill, Lanarkshire.

School Stage Lighting

A booklet of value to those who organise dramatic performances in schools, colleges and technical institutes has been prepared by the Strand Electric & Engineering Co., Ltd. The growing importance of school stage lighting has increased the desirability of modern lighting equipment, and the company has worked in close co-operation with many educational authorities and their technical consultants in this connection. The booklet discusses general principles and makes useful suggestions.

Twine Factory Electrification

A change from low-speed condensing steam engine drive to numerous direct drives by electric motors has been completed at the twine factory of John Holmes & Sons, Ltd., East Ardsley. Crompton Parkinson motors totalling 400 HP drive a variety of machines. The majority are "Textork" motors which have as characteristics even acceleration as well as a satisfactory starting torque. For example, a 30-HP "Textork" motor V-rope driving the latest type 80-spindle flyer doubler starts against load and rises to full speed in five seconds with practically no breakages of threads. Similar characteristics apply to a 10-HP motor driving an older type, double-sided twister machine, and a 20-HP "Textork" motor driving a modern high-speed ring doubler. The three additional new heavy ring doublers in use are driven by a 25-HP and two 20-HP motors. All these machines reach maximum speed in 5 sec. A 70-HP Crompton Parkinson slip-ring motor drives by line shaft seven twine polishing machines, and a 35-HP motor V-rope drives on to a line shaft operating heavy twisting frames. Altogether there are twenty-four motors either direct driving or on short shafts. The wiring installation was carried out by Mr. C. S. Colbeck, of Wakefield.



Crompton Parkinson motors in the twine factory of John Holmes and Sons, Ltd.

Wilmslow Electrical Entertainment

On March 14th and 15th the Alderley Edge & Wilmslow Electricity Board (chief engineer and manager, Mr. C. Cameron Kirby) staged an entertainment designed to attract the housewife in the higher income category as a large number of homes in the Wilmslow district are of this type. The entertainment, which was compèred by Mr. W. H. Rylance of the General Electric Co., Ltd., included the E.D.A. films "News by Wire" and "The Good Old Days" and a demonstration of the new de-luxe G.E.C. automatic electric cooker. Altogether four performances were given and about 1,600 people attended. An indication of the success of this enterprise in attracting the wealthier housewife was shown by the large number of cars in the car park. The sales resulting have been most satisfactory.

Automobile Lamp Price Indicator

The General Electric Co., Ltd., has issued a new "Osram" car bulb price indicator and stock control chart (Ref. OS.8628), by which bulbs required for any particular car can be automatically selected, the prices being shown by a revolving indicator.

Employment in February

Employment showed some improvement between January 16th and February 13th in most of the principal sections of the engineering industry and was fairly good on the whole, being good in electrical engineering. According to the *Ministry of Labour Gazette* the number of unemployed in the engineering industry was 86,551, a decrease of 6,132 as compared with the preceding month, or 0.5 per cent., but an increase of 0.2 per cent. as compared with February, 1938. In electrical engineering the number out of work was 6,456, the percentage falling by 0.2 to 5.5 (4.6 per cent. in February, 1938). Unemployed in the electrical wiring and contracting section amounted to 4,683, or 11 per cent. (against 12 per cent. in January, 1939, and 10.6 per cent. in February, 1938). In the electric cable, apparatus, lamps, &c., group there were 13,716 unemployed, the percentage (7.7) falling by 0.1 as compared with January, and 1.7 per cent. as compared with February, 1938.

A Factory Lighting Installation

A notable example of modern lighting is provided by the installation at the new factory of Hugh Wood & Co., Ltd., and Huwood Mining Machinery, Ltd., on the North Eastern Trading Estate, Gateshead-on-Tyne. It was decided to adopt a scheme of "Mercra" lighting suggested by the British Thomson-Houston Co., Ltd., and as it was intended to install a number of comparatively high-speed machines particular care had to be taken that the stroboscopic effect peculiar to electric-discharge lamps should cause no inconvenience. With this in view, the installation was designed so that at any point light was received from lamps on the three phases, the stroboscopic effect produced by one lamp being neutralised by the

other two lamps. As a result it is almost impossible to detect any stroboscopic effect even when deliberately looking for it. In the main bay twenty-eight 400-W "Mercra" lamps in "Mazdalux" dispersive reflectors mounted at a height of 26 ft. and a spacing of 30 ft. by 25 ft. were utilised to give an average illumination at floor levels of 8 ft.-candles. In the side bays machining to fine limits is carried on, and here it was decided to provide 15 ft.-candles on the plane 2 ft. 6 in. above floor level. These bays are only 11 ft. in height so 125-W "Mercra"

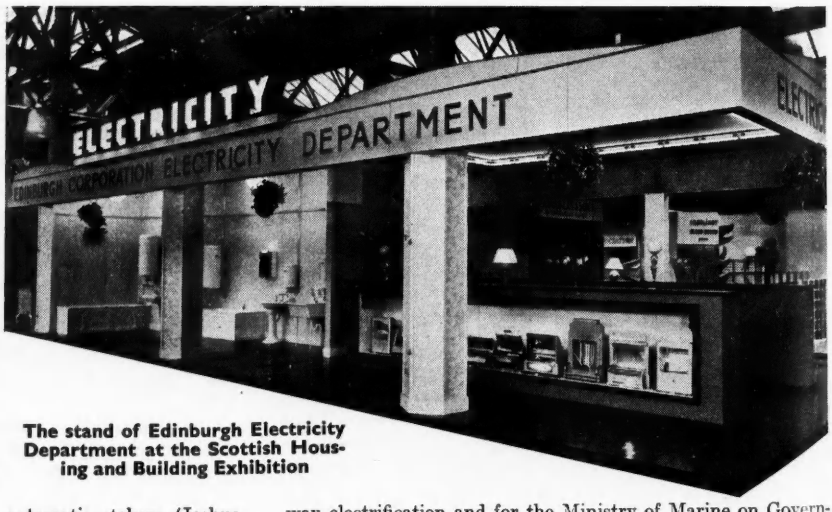
B.T.H. lighting fittings in the drawing office of Hugh Wood and Co., Ltd., and Huwood Mining Machinery, Ltd.

lamps in dispersive reflectors were used mounted at ceiling level at a spacing of 13 ft. The main lighting of the offices is by means of "Mazda" lamps in special enclosing fittings. In the case of the drawing office, however, especially good lighting was required, and specially designed fittings were made to give shadowless illumination to an intensity of 25 ft.-candles. Each fitting, which houses a 150-W bowl silvered lamp is arranged so that the majority of light incident on the board is received from the far left-hand corner in order to avoid any shadow from tee or set square. The large reflector ensures complete lack of reflected glare. The installation was carried out by Watson-Norie, Ltd.

Scottish Housing and Building Exhibition

Easily the largest display at the Housing and Building Exhibition held last week at the Waverley Market, Edinburgh, was that arranged by the City Electricity Department. Having recently introduced a hire scheme for water heaters, the Department made a special feature of this class of apparatus, examples of all types being shown, many in sectional form. The interest which the exhibit created among the public can be judged by the statement by Mr. A. W. Stevens, the assistant sales superintendent, that more than half the inquiries received were concerned with water heating. Actually since last August, some 250 heaters, mostly of the immersion type, have been connected by the Department. Separate sections of the display were also provided for cookers, fires, kitchen equipment and miscellaneous appliances, the fires being shown in a recessed display stand which shielded them from the tubular lamps used for the stand illumination.

A novel unit useful for heating the foot of a bed, &c., was a bowl fire mounted on a pedestal with a swivel joint. Among the displays of individual companies were noticed two of the latest ranges of American-made home laundry equipment—the "Barton" machines marketed in this country by Baxendale & Co., Ltd., and the "A.B.C." models (Altorfer Bros. Co.) for which the agents are the Sunbeam Electrical Appliances Co. Beatty Bros. also showed washers, and other electrical items included vacuum cleaners (Tellus and "Goblin"); convection and unit heaters (British Trane "Univectairs," British Unit Heater & Radiator Co.'s "Copperad" and E. K. Cole "Thermovent"); automatic telephone, call fire alarm and clock systems (Automatic Telephone & Electric Co.); automatic stokers (Joshua Bigwood & Son); and refrigerators (Frigidaire).



The stand of Edinburgh Electricity Department at the Scottish Housing and Building Exhibition

Stage Amplifying Equipment

The new Spa Pavilion at Felixstowe, which is to be opened on April 8th, will be equipped with stage amplifying equipment installed by the British Thomson-Houston Co., Ltd. The equipment consists of a rack and panel amplifier unit incorporating a 15-W undistorted output amplifier, three-channel microphone mixing panel, and monitor speaker. Two multicellular horns containing powerful curved cone permanent-magnet speakers are mounted on each side of the stage, while the sound input is through three velocity ribbon microphones of which two are mounted in the footlights and the other on an extending stand for solo items.

Trade Announcements

Bill Switchgear, Ltd., is changing its London address to Autophone House, 23-31, Great Peter Street, Westminster, S.W.1 (telephone: Abbey 4518), where there will be larger stores than those previously held at Balham. Mr. Payne has been appointed assistant to Mr. Zelley for the London area. The company expects to be in the new premises by April 14th.

The Newcastle office of George Ellison, Ltd., has been moved to more spacious premises in Watson House, Pilgrim Street. The telephone number and telegraphic address are unaltered.

The Witton works of the General Electric Co., Ltd., will be closed on March 31st and April 1st for the annual stocktaking. They will reopen on Monday next.

The head offices and warehouses of Brown Bros., Ltd., at Great Eastern Street, London, E.C.2, will be closed from April 6th until April 11th, and on the latter date they will close at 4 p.m.

The works and offices of Higgs Motors will be closed from April 7th to 11th inclusive.

The Siemens-Schuckert "Fotomax" camera for attaching to meters to check the load conditions, a description of which appeared in our issue of June 17th, 1938, is sold in this country by Robert Hornby & Co., Ltd., 7, Carlisle Street, London, W.1.

A Comprehensive Electrical Catalogue

The general catalogue of the Westinghouse Electric International Co. of America, which we have received from the Lightfoot Refrigeration Co., has 1,228 quarto art pages, profusely illustrated, and contains complete technical articles on practically every type of electrical equipment. The book is well bound and thumb indexed for the twenty-four divisions.

Boiler Plant for Portsmouth

Bennis Combustion, Ltd., has been awarded the contract for the new boiler plant for the Portsmouth Corporation power station, including two 150,000 lb. per hour quadrum boilers, stokers, and coal- and ash-handling plant.

New Showrooms and Offices at Norwich

The Norwich Corporation electricity undertaking is to have new showrooms and offices at an estimated cost of £85,000. The building is to be erected on the new City Hall site.

French Electrical Production

Our Paris Correspondent says that the production of electrical apparatus and machinery in France is still far from satisfactory, according to the report on an inquiry conducted by the trade unions. As a general rule, their report indicates, small and moderate-sized machines and apparatus are finding little scope. Large machines and apparatus, on the other hand, continue to show the good effects of the intensive plan of electrification which is in progress. Various companies, therefore, are doing either well or badly according to the type of material they produce. Thus, the Alsthom plant at Belfort, although it is producing a certain amount of material for railway electrification and for the Ministry of Marine on Government contracts, is obliged at present to take about 70 per cent. of its production into stock. The Société Savoisienne de Construction Electrique, which produces large machines almost exclusively, is, according to the report, doing fairly well for the moment. These figures are interesting, in that they indicate that the great mass of business for the constructional industries is at the present coming rather from a development

of productive capacity than from a development of consumption. This situation is temporary, of course, and improved general conditions will change it.

E.D.A. Activities

In its sales and publicity programme for April the British Electrical Development Association reminds members of the publicity material which it has available in connection with the national water-heating campaign. The Association also has a number of advertising novelties such as "I'm Electric" dolls, handbag mirrors, bookmarks and whist score cards to link up with special celebrations, exhibitions or other functions. An appeal is made to members to notify the Association as early as possible of dates on which they may require the carnival car for 1939. Details of the car will be published in next month's programme. "I'm Electric" enamelled brooches and a transfer of the figure for embroidery are still available for sports and other clubs.

Orders for Electrical Goods in U.S.A.

Orders booked for electrical goods in the United States in 1938 were valued at $630,801,657, as compared with $930,170,357 for 1937, reports *Reuter's Trade Service* from New York. The value of orders booked during the fourth quarter of last year was $160,374,036 against $182,306,350 for the corresponding period in 1937. The report covers electric motors, storage batteries, domestic appliances, industrial equipment, and other electrical apparatus and supplies. The figures are presented, says the Department of Commerce, not as a complete statement, but as sufficiently representative to indicate the trend.

Gainsborough Electrical Exhibition

An electrical exhibition organised by the Gainsborough U.D.C. Electricity Department was held last week at the Town Hall, at which domestic electrical appliances were on view and cooking and other demonstrations were given each day. A popular feature of the exhibition was the showing of the E.D.A. films, which we learn from Mr. H. Breckell, the engineer and manager of the electricity undertaking, attracted about 2,700 visitors during the week's run of the exhibition.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price March 29th	Fortnight's inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£37	—
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax... ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 8s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium, Bichromate, casks ... per lb.	4¼d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£94	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/2½ to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£197	—
Grade II ... ... ,,	£137	—
Grade III ... ... ,,	£73	—
c Brass (rolled metal 2" to 12" basis)... per lb.	8¼d.	—
c ,, Tubes (solid drawn) ... ... ,,	11¼d. to 11¾d.	—
c ,, Wire, basis ... ... ,,	8¼d.	—
c Copper Tubes (solid drawn) ... ,,	1/0¾d.	—
g ,, Bars (best selected) ... per ton	£80	£2 inc.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£49 5s.	—
d ,, ,, Wire Rods ... ,,	£54	—
d ,, ,, H.C. Wire ... per lb.	7½d.	—
f Ebonite Rod ¼" dia. & up. ... ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	Nom.	—
h India-rubber, Para-fine ... ... ,,	7¼d.	—
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 15s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... per bot.	£16 15s.	5s. dec.
g Mercury ... ... per bot.	£16 16s. 6d.	8s. 6d. inc.
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e ,, ,, ,, medium ... ,,	6/– to 12/6	—
e ,, ,, ,, large ... ,,	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	—
p ,, ,, drawn bars & rods ,,	1/1d.	—
p ,, ,, rolled strip & sheet ,,	11¼d.	—
b ,, ,, wire ... ... ,,	1/1¾d.	—
o Platinum ... ... per oz.	£7 10s.	—
d Silicum Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£13 13s. 9d.	2s. 6d. dec.
g Tin, Block (English) ... ... ,,	£216 5s.	£1 5s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e P. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in this section under the same heading.

Siemens' New Glasgow Premises

The Glasgow branch of Siemens Electric Lamp & Supplies, Ltd., has removed from 25, Cadogan Street, to 19-23, West Campbell Street, Glasgow. The telephone numbers and telegraphic address remain unchanged. In the new building, the imposing exterior of which is shown in the accompanying

New Siemens premises in Glasgow

illustration, the company has greatly improved facilities for carrying larger and more varied stocks of its products and there is a much improved showroom for displaying them. In addition there is a wholesale trade counter.

New Catalogues and Lists

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—An illustrated leaflet dealing with a new range of lighting fittings. A 48-page illustrated catalogue of enclosed lighting fittings has also been issued.

T. W. Ward, Ltd., Albion Works, Sheffield.—A 568-page catalogue of machinery, engineers' tools, engines, boilers, contractors' plant, &c.

Sun Electrical Co., Ltd., 118, Charing Cross Road, London, W.C.2.—An illustrated 24-page catalogue of electric tools.

Switchgear and Cowans, Ltd., Elsinore Road, Old Trafford, Manchester, 16.—A descriptive brochure dealing with flameproof mining type switch-transformer equipment.

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—A folder dealing with "Aeroto" patent screw fans.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—An illustrated list of house service cut-outs and power fuse boxes.

W. Edwards & Co., Allendale Works, Southwell Road, Loughboro' Junction, London, S.E.5.—A list dealing with "Kipp" galvanometers.

Brush Electrical Engineering Co., Ltd., Loughborough.—The first copy of the "Brush Petter News" has just been issued in English, French and Spanish.

Private Arrangements

H. W. Major, 590, Great Horton Road, and 402, Manchester Road, Bradford, electrical dealer, &c.—At a recent meeting of the creditors the statement of affairs disclosed liabilities of £342 and net assets of £189, leaving a deficiency of £153. It was decided that the debtor should execute a deed of assignment in favour of Mr. R. Lindley as trustee, with a committee.

C. W. Harman, 4, Graham Road, Worthing, late of 96a and 96b, Montague Street, Worthing, trading as Harman's, radio dealer and engineer.—A meeting of the creditors was held on March 24th at the offices of Mr. A. E. Orbell, accountant and auditor, 6-7, Old Steine, Brighton. The statement of affairs showed liabilities of £657. The net assets were £30, leaving a deficiency of £627. It was stated that a friend of the debtor was prepared to pay out the distress for rates and had handed over to Mr. Orbell a sum of £110 for distribution among the creditors, subject to that being accepted in full settlement of their claims. It was decided that that offer should be accepted.

Bankruptcy Proceedings

F. Ll. Bollen, radio and electrical engineer, Piddletrenthide, Dorset.—Receiving order made March 17th on debtor's own petition. First meeting March 31st at 12, Rolleston Street, Salisbury. Public examination, April 21st, at the County Hall, Dorchester.

A. E. Cowes, radio and electrical engineer, 113, Mount Pleasant Road, Tottenham, N.17.—Application for discharge to be heard on April 21st at the Town Hall, Lower Edmonton, N.9.

A. F. Peacock, radio engineer, 15, Bank Street, Teignmouth.—Last day for receiving proofs for dividend April 5th. Trustee, Mr. W. R. Cocks, Exeter Bank Chambers, Broadgate, Exeter, Official Receiver.

P. D. Watkins, radio engineer, 43, High Street, Criccieth.—Supplemental dividend of 1¼d. in the £, payable April 7th at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

T. C. Taylor, electrical contractor, 20, Queen Street, Blackpool.—Receiving order made March 20th on a creditor's petition. First meeting, March 31st, at 9, Fox Street, Preston. Public examination, April 28th, at the Court House, Blackpool.

C. H. Parsons, wireless dealer, 38, East Reach, Taunton.—Receiving order made March 20th on debtor's own petition.

C. Richmond, electrical and radio engineer, 7, Royd Crescent, Clay Pitts Lane, Halifax, formerly carrying on business as C. Richmond & Son, 73, Hanson Lane, Halifax, and 17a, Acorn Street, Halifax.—Receiving order made March 20th on debtor's own petition.

C. T. Hicks, electrical engineer and contractor, 81, High Street, Witney, Oxford.—Receiving order made March 20th on debtor's own petition.

B. J. Wheldon, electrician and wireless salesman, 336, Londonderry Road, Langley, Oldbury.—Receiving order made March 17th on debtor's own petition. First meeting, April 3rd, at 37, Temple Street, Birmingham. Public examination, April 14th, at the Law Courts, West Bromwich.

E. G. Kelf, 140, Ivy Road, Cricklewood, N.W.2, lately carrying on business in copartnership with another as "E. G. K." at 4, High Road, Willesden Green, N.W.10, radio dealers.—Discharge suspended for six months until August 23rd, 1939.

H. F. Pitman (Elect. Radio Service), radio dealer, 1, Pine Parade, Wallisdown, Bournemouth.—Last day for receiving proofs for dividend, April 7th. Trustee, Mr. A. L. Medcalf, 10, Rockstone Place, Southampton.

W. L. M. Jones, 118, High Street, Blackwood, Monmouthshire, wireless dealer.—The adjourned public examination took place at the Town Hall, Tredegar, recently. At the previous hearing the statement of affairs showed a deficiency of £457. The examination was adjourned *sine die*.

Company Liquidations

John Holder & Co., Ltd., electrical engineers, 80b, Dean Street, London, W.—Observations relating to the winding-up of this company have been issued by the Official Receiver. The statement of affairs shows liabilities of £3,520, of which £2,984 is expected to rank for dividend, against assets £413. Mr. H. P. Naunton, Official Receiver, reports that the company was formed in November, 1933, and its failure was attributed to shortage of liquid capital, increases in overhead expenses, errors in estimating on contracts, general slackness of trade, and difficulty in collecting certain accounts owing to the company. As a result of the statutory meetings of creditors and shareholders, the Official Receiver remains the liquidator of the company.

Frederick Groves, Ltd., radio dealers, 273, High Road, Leytonstone, London, E.—The statutory meeting of creditors was held on March 24th at Winchester House, Old Broad Street, London, E.C., when a resolution was passed confirming the voluntary liquidation of the company with Mr. J. Tresmond as liquidator. A committee was also appointed consisting of Mr. H. Treby and the representatives of the Gramophone Co., Ltd., and the British Traders' Association. The statement of affairs showed ranking liabilities of £1,369 and net assets were £52, leaving a deficiency, as regarded the creditors, of £1,317. The issued capital of the company was £1,400, and so far as the shareholders were concerned there was a deficiency of £2,717.

Real Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. A. E. Middleton, 18, Essex Street, Strand, London, W.C.2. Particulars of claims to the liquidator by March 31st.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

SHELLINGTON axe for cutting live wires.

SLATER'S MAXAMP connectors.

Stoke-on-Trent Premises Extended

Completion of Change-over

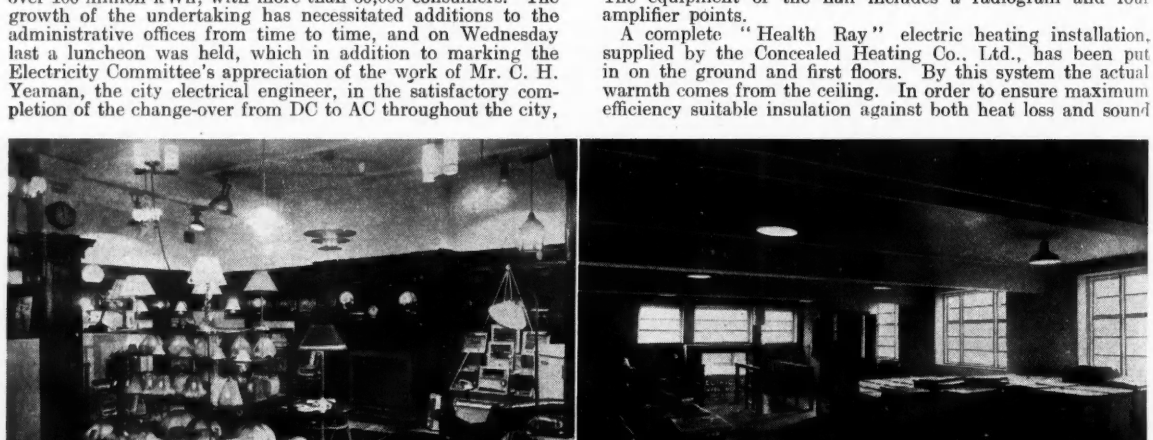
OVER a quarter of a century ago work was commenced on changing the four different system of electricity supply in what is now the city of Stoke-on-Trent to the standard system of AC, 50 cycles. This task having now been completed, and the 6,600-V distribution network begun in 1913 being incapable of much further extension economically, work is now in hand on a supplementary 33,000-V network, the first section of which (Stagefields to Stoke sub-works) was laid in 1938 and put into commission on December 19th last. The second section (Stagefields to Burslem sub-works) has, as regards most of the scheme, received the sanction of the Electricity Commissioners and is proceeding at the present time.

Since 1910 the annual output of the electricity undertaking has risen from five million kWh, with 2,500 consumers, to over 100 million kWh, with more than 60,000 consumers. The growth of the undertaking has necessitated additions to the administrative offices from time to time, and on Wednesday last a luncheon was held, which in addition to marking the Electricity Committee's appreciation of the work of Mr. C. H. Yeaman, the city electrical engineer, in the satisfactory completion of the change-over from DC to AC throughout the city, also celebrated the opening of extensions to the electrical engineer's offices in Kingsway, Stoke-on-Trent.

The offices were transferred to Kingsway in October, 1924, and incorporated a showroom. Three years later the showroom was extended, and a further extension was made in 1937. Excluding the extensions opened on Wednesday last, there are twenty-four offices, two shops, a demonstration kitchen and a showroom accommodating a total staff of 117. The new extension comprises a basement and two floors which have been built on the south-west side of the old building.

The basement has been fitted up as a gas-proof and splinter-proof air raid shelter for the protection of the staff. There are four cellars which are electrically lighted, and provision is made for emergency lighting from a battery supply should the public supply be stopped. The ground floor includes an entrance hall, two rooms and a cooker store, while on the first floor is a spacious lecture theatre with a movable stage. At one side of the stage is a lift for bringing cookers and other apparatus up to the lecture theatre. The ceiling of the theatre is of special design in which 140 ft. of concealed lighting has been provided in a cornice. There are four dome lights in the ceiling and from the domes ventilation shafts are carried in the false roof to an electric fan built in the wall. The equipment of the hall includes a radiogram and four amplifier points.

A complete "Health Ray" electric heating installation, supplied by the Concealed Heating Co., Ltd., has been put in on the ground and first floors. By this system the actual warmth comes from the ceiling. In order to ensure maximum efficiency suitable insulation against both heat loss and sound is provided by means of a special reinforced aluminium foil diaphragm arranged over the entire area of the "Health Ray" wiring. The heating is controlled thermostatically and is designed to provide a room temperature of 62 deg. F. with an external temperature of 32 deg. F. The thermostats are provided with adjustable dials and the system is designed to afford uniform heating with a variation of only 2 deg. F. between the "Health Ray" system or any of the four walls. The loading is 47 kW, of which 18 kW is in the lecture hall.



The showroom and cooker store at the premises of the Stoke-on-Trent Electricity Department, extensions to which were opened on Wednesday last

ELECTRICITY SUPPLY

Victory for Public Supply at Hull. Morecambe Showroom Sales Decision. "Nesco" Tariff Reductions. Arbitrator's Awards on Rotherham Area Extension

Aberystwyth.—PROPOSED SUB-STATION.—The Town Council is to purchase a site for a sub-station at the Waun.

Aylesbury.—POSSIBILITY OF LOWER CHARGES.—A special sub-committee of the Electricity Committee is considering the possibility of bringing about a reduction in the charges for shops, business and combined premises.

STREET LIGHTING.—An additional sixteen lamps are to be erected on the Turnfurlong estate at a cost of £192.

Bournemouth.—ELECTRIC STREET LIGHTING.—The Lighting Committee has accepted a quotation by the Bournemouth & Poole Electricity Supply Co. for intermediate road lighting by 125-W lamps during the next two years. The annual cost is just over £2,000.

Brighton.—FIRE PRECAUTIONS.—To cover the cost of dividing the control room at the Southwick power station into two fire-proof sections to accommodate new 33,000-V switchgear the Electricity Committee is applying for permission to borrow approximately £9,000.

DISTRIBUTION WORKS.—A new sub-station is being built in connection with the supply to 117 houses now being erected on the Redhill Farm estate, and a loan of £2,505 is required for the purpose, with an additional £1,416 for a high-voltage feeder and pilot cables. In view of the impending change-over to AC in the Hollingbury area it is proposed to lay a 33-kV ring main, for which application is being made for permission to borrow £6,000. A change-over is also contemplated in the Dyke Road area, where a block of seventy-two flats is now being built, and it is proposed to build a sub-station in the district. Application is being made to borrow £2,470 towards the cost.

Burnley.—LOAN FOR ELECTRICAL APPLIANCES.—The Electricity Committee on Monday discussed a resolution of the Town Council instructing it to consider either increasing the price of electricity or obtaining from the Electricity Commissioners sanction to a loan to cover a debt on appliances and the assisted-wiring scheme under the hire-purchase system consequent on the new Hire Purchase Act. The Committee agreed to adopt the loan policy.

Cardiff.—ENLARGING THE ROATH POWER STATION.—It was indicated at last week's meeting of the Electricity Committee that besides the extensions at the Roath power station already announced others costing about £400,000 are contemplated, bringing the expenditure up to approximately £1,100,000. Mr. E. Jones, the city electrical engineer, stated that the whole work in view at the power station would take about fifteen years to complete.

Herne Bay.—MAINS.—The Council has given permission to the Herne Bay & District Electricity Supply Co., Ltd., to lay mains in Lismore Road and in the Herne Bay-Canterbury road, subject to the surveyor's approval of the route.

Hull.—A LARGE CONSUMER.—Negotiations have been concluded as a result of which the Electricity Department will take over the supply to a local company, involving an increase in output of about 8,000,000 kWh a year. At a meeting of the Electricity Committee last week Mr. D. Bellamy, the general manager, stated that a year ago the company installed a 1,000-kW turbine for the generation of its own supply, and recently it was considering further extensions at the works and the installation of generating plant with an output of 6,000,000 kWh per annum. He had been in negotiation with the company and had made arrangements to take over the supply. This meant an increase of about £10,000 in the revenue of the Department, which could use the turbine to reduce the peak load. He considered that this successful negotiation was a particular triumph for the Department and for the public supply of electricity. The chairman (Alderman Benno Pearlman) said that the Committee and the public should be pleased at the business acumen displayed in this matter by the general manager. The Committee placed on record its thanks to Mr. Bellamy.

Ipswich.—SITE FOR NEW POWER STATION.—The Electricity Committee recommends the purchase of 86 acres for the proposed new Cliff Quay power station and has approved a scheme prepared by Merz & McLellan for its development at a total cost of £1,907,125. The arrangements for the new station have been incorporated in an agreement with the Central Electricity Board.

BETTER STREET LIGHTING.—The Corporation is to improve the street lighting at a cost of £4,000.

Jarrow-on-Tyne.—NEW SUB-STATION.—The Town Council has approved plans for a sub-station on the site of the old cement works for the North-Eastern Electric Supply Co., Ltd.

STREET LIGHTING REPORT.—The borough engineer (J. S. Weir) is to report to the Town Council on the comparative costs of lighting various streets in the town by gas and electricity.

Johnstone (Renfrewshire).—ELECTRIC STREET LIGHTING PROPOSAL.—A proposal to change the present street lighting from gas to electricity is to be made at the next meeting of the Lighting Committee of the Town Council. The scheme is estimated to cost £4,000.

London.—POPLAR.—The Borough Council is to erect a sub-station on a site in St. Leonard's Street, Bromley-by-Bow.

As an experiment the Electricity Committee is to install meters of the type that can be adjusted to collect fixed charges as well as running charges in forty to fifty houses.

SCHOOL LIGHTING.—The L.C.C. is to install electric lighting in the Churchdown (Lewisham), Hay Currie (Poplar) and Kilmorie (Lewisham) schools.

Macclesfield.—PURCHASE OF UNDERTAKING.—The Corporation and the Electricity Co. of Macclesfield, Ltd., have agreed, in principle, to the purchase by the Corporation of that part of the company's undertaking not included in the notice served by the Corporation in August of last year. This means that the Corporation will purchase the whole of the company's undertaking, including Macclesfield borough, Bollington urban district and the bulk of the Macclesfield rural area. A price has been agreed upon for the acquisition of the undertaking outside the borough and the amount to be paid by the Corporation for the portion within the borough will be fixed by arbitration. Macclesfield Rural District Council has passed a resolution expressing the opinion that the supply of electricity to consumers in its area should be made on terms similar to that in Macclesfield borough.

Manchester.—CHANGING FROM GAS TO ELECTRICITY.—The Denton U.D.C. has applied to Manchester Electricity Department for a supply to houses on the estates at Denton built some years ago. Negotiations have been proceeding for some time with a view to persuading the Council to undertake the installation themselves instead of the tenants making their own arrangements with the Department under the assisted wiring scheme, and it is satisfactory to note that the Council has now decided on the former course. In addition to a complete lighting installation, each house will be equipped with power plugs for electrical appliances. There are altogether 204 houses.

The Manchester Housing Committee has agreed to install electricity for the tenants of tenements at Chester Street, Chorlton-on-Medlock, at present lighted by gas. The installations will comprise a lighting point in each room and a 5-A plug in the living room for electric iron or radio, &c. The Committee has consented to the tenants of Corporation houses on the estates taken over from the Bucklow Rural District Council on the incorporation of Wythenshawe within the city in 1930 having electricity installed at their own expense under the terms of the Electricity Department's assisted wiring scheme. There are three estates affected, with 175 houses.

Morecambe.—SHOWROOM SALES.—The electrical engineer recently submitted a report and a summary of replies to a questionnaire which he had circulated to sixty-six electricity supply authorities regarding showroom sales. The Committee decided that the sale of appliances, &c., in the showrooms should be unrestricted, with the exception of lighting fittings, radio sets and wiring installations (apart from the necessary wiring for appliances supplied), cash discounts to be reduced from 5 to 2½ per cent. With regard to all appliances of low consumption, the initial payment is to be one-eighth of the cash price of the appliances (with a minimum of £1), the remaining amount to be on hire-purchase terms. Consideration of combinations of various appliances being made available to consumers at reduced terms has been deferred.

Motherwell.—OPPOSITION TO ORDER WITHDRAWN.—The opposition to the Motherwell and Wishaw Provisional Order for the extension of the burgh's electricity supply, &c., by the Lanark County Council and the Clyde Valley Electrical Power Co. has, it is learned, now been withdrawn. The Order was to have been considered by a committee of inquiry.

Musselburgh.—BULK SUPPLY.—Increased demands for wire manufactures by the Admiralty, War Office and Air Ministry have necessitated an augmentation of the electricity supply to Bruntons, Ltd., wire and wire rope manufacturers, Musselburgh, and in addition to the power from its own generating plant a 10,000-V bulk supply is to be taken from the Lothians Electric Power Co.

Newcastle (Staffordshire).—STREET LIGHTING.—The Town Council is to carry out improvements to the street lighting at an estimated cost of £10,153.

North-West Midlands.—OPPOSITION TO POWER STATION SCHEME.—Strong objection to the proposal of the North-West Midlands Joint Electricity Authority to erect a large power

station at Barlaston was expressed at a recent meeting of the Stone Rural District Council, which appointed a special committee to organise effective opposition.

North East Coast.—REDUCED CHARGES.—The North-Eastern Electric Supply Co., Ltd., is to make further reductions in electricity charges beginning April 1st. The prepayment meter tariff is to be reduced from 3½d. to 3d. a kWh, and there will also be a concession to shopkeepers. On the shop tariff the primary rate on the sliding scale will remain at 3½d. a kWh and the amount charged at the secondary rate of 2½d. will be reduced from 3,000 to 2,000 kWh a quarter, after which consumers will take the third rate which is being reduced from 1½d. to 1d. a kWh. The primary rate is charged according to the size of the shop.

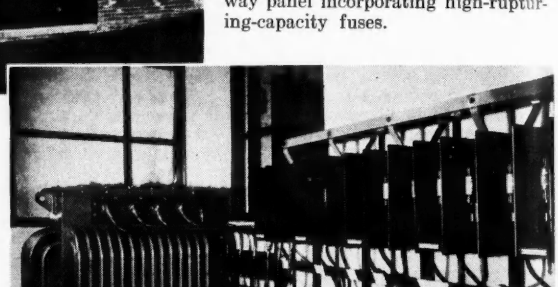
Rotherham.—NEW POWER PLANT COMMISSIONED.—The extensions to the Prince of Wales power station of the Rotherham Corporation electricity undertaking described last week were formally opened on March 22nd by a former Mayor, Mr. A. R. Habershon, who for ten years was chairman of the Electricity Committee. The ceremony was performed at a luncheon at the Town Hall, when Mr. Habershon operated a switch to set in motion the new turbo-alternator at the station half a mile away. Presiding at the luncheon, Councillor H. Lake, chairman of the Electricity Committee, said that to their present engineer, Mr. W. H. Duffett, they owed in large degree their low cost of generation. As a gift from the contractors Mr. Lake handed to Mr. Habershon a gold cigarette case. Following the luncheon a visit of inspection was made to the power station. Further extensions, it is understood, are in contemplation.

ARBITRATOR'S AWARDS.—Following the transfer to the Corporation of the parts of the undertakings of the Yorkshire Electric Power Co. and the Electrical Distribution of Yorkshire, Ltd., within the area added to Rotherham by the Doncaster, Rotherham and Wakefield Extension Order, 1936, claims made by the two companies against the Corporation in respect of the transfer were referred to arbitration. The arbitrator, M. W. P. Spens, K.C., has awarded £32,020 to the Yorkshire Electric Power Co., who claimed £75,600, and £61,094 to the Electrical Distribution of Yorkshire, Ltd., who claimed £83,426.

Stoke-on-Trent.—SUPPLY EXTENSIONS.—The Electricity Committee is to provide a supply to eighty-eight houses to be erected by W. Leake & Co. on a building estate off Hanley Road, Sneyd Green, at a cost of £870. It is also to provide additional mains in Market Square and Market Street, Tunstall (£800), and augment the supply to the Abbey Hulton housing

Distribution Improvements at Whitworth

TO meet the increasing demands both for domestic and industrial supplies the Whitworth U.D.C. decided last year to carry out additions to the system at an estimated cost of £5,500. Approximately 1¾ miles of additional high-voltage cables have been laid and jointed, new sub-stations erected at Hall Street and Orama Mill, Whitworth, and at Peel Mill, Shawforth, and high-rupturing-capacity switchgear installed. A number of alterations and additions to the low-voltage distribution system were put in hand last year, including the provision of an outdoor kiosk at Millgate, new low-voltage distribution panels incorporating high-rupturing capacity fuses, and 1,750 additional kVA of transforming plant. The object was to increase the capacity of the undertaking to deal with an eventual load of 4,000 kVA of m.d. anticipated within the next five years.



The new main sub-station at Hall Street, Whitworth, and the interior of the low-voltage compartment

The contracts for the laying of additional high-voltage feeders, sub-station equipment, control switchgear, transformers, kiosk and low-voltage distribution panels, &c., were placed with Johnson & Phillips, Ltd., and the new equipment was formally put into commission on March 22nd by the chairman of the U.D.C., Coun. Mrs. I. Heys, and by Coun. G. Kershaw, M.I.Mech.E., chairman of the Electricity Committee since 1923. After the switching-in of the extensions and additions to the distribution system there was a dinner at the Flying Horse Hotel, Rochdale, at the invitation of Johnson & Phillips.

The new sub-station at Hall Street (a main sub-station situated at the load centre) is a brick and stone building having lofty and pleasing lines and of modern design. Safety features have not been neglected, and the high-voltage switchgear occupies a compartment separate from the low-voltage switchgear, transformers and distribution panels. The cable trenches run the full length of the sub-station building and are continued outside and connected to waste water drainage system.

The high-voltage switchboard consists (initially) of five J. & P. cubicles and truck switchgear having a rupturing capacity of 150 MVA. The board incorporates duplicate busbars with selective switches. Met-Vick "P.B." directional overcurrent and earth relays are mounted on the truck panels. Provisions exist for readily increasing the number of cubicles to nine.

The low-voltage switchboard in the sub-station consists of a six-way distribution panel incorporating high-rupturing-capacity fuses. The separate circuits are arranged in a single horizontal line instead of tier fashion, and the fuses are attached to isolators for ease of operation. A 250-kVA transformer with tap-changing gear is installed in the same compartment.

At the Orama Mill sub-station, truck switchgear of J. & P. design is installed to separately control one 750-kVA and one 500-kVA transformers, both with tap-changing gear. This sub-station is largely concerned with industrial supplies to the Orama woollen mill.

The Peel Mill sub-station, Shawforth, is largely for industrial supplies to the premises of Gaskell & Co., Ltd., felt manufacturers. Here, again, truck switchgear of the ring-main type has been installed, together with a 250-kVA transformer incorporating tap-change gear.

At Millgate there is a sheet-steel kiosk having ring-main isolators and oil-circuit-breakers (rupturing capacity 150 MVA) to control incoming and outgoing feeders and a 150-kVA local transformer. The low-voltage distribution board consists of a five-way panel incorporating high-rupturing-capacity fuses.

Approximately ¾ mile of 0.2 sq. in., three-core, p.i.l.c. cable suitable for working on a 6,600-V (unearthed) system and one mile of 0.15 sq. in. cable have been drawn into existing ducts to duplicate cables of similar cross-section already existing.

At the dinner following the opening ceremony, Mr. H. Barber, of Johnson & Phillips, Ltd., said that although these were difficult times for the cotton trade, which naturally affected the prosperity of Whitworth, he felt sure the Council was wise in taking the long-term view and building in advance of the promised trade revival. The record of the electricity undertaking was indeed an impressive one and, no doubt, the Council must feel that they had been most fortunate in their choice of engineer and manager, Mr. J. Ratcliffe.

Coun. Kershaw said that during his many years of service as chairman he had seen many changes and several innovations, but the thing he would most like to see materialise was standardised tariffs to consumers throughout the country.

Over 80 per cent. of the premises in the supply area are now connected to the mains, and one in five consumers hires an electric cooker and wash boiler—in all future houses erected by the Council electric wash boilers are to be installed as a matter of course. Public lighting is 82 per cent. electric.

site (£950). Sub-stations are to be built in Sandon Road, Meir; Poplar Drive, Blurton; and Stuart Avenue, Trentham.

Scotland.—A.R.P. REHEARSAL.—Last Monday, between 10 p.m. and midnight, there took place the biggest A.R.P. "black-out" yet held in Great Britain. It covered the counties of Fife; Stirling; Clackmannan; West, Mid and East Lothians; Peebles; Berwick; Selkirk and Roxburgh. The photo shows one of the thirty-two Gent syrens provided at Edinburgh. The Palace of Holyrood is in the background.

[*Elec. Rev. photo.*

One of the Gent A.R.P. syrens used at Edinburgh

Tynemouth.—BULK SUPPLY.—Representatives of the Town Council have had an interview with the North-Eastern Electric Supply Co., Ltd., regarding the extension of the bulk supply of electricity to the borough. A comprehensive scheme has been prepared and has been referred to the Electricity Supply Committee of the Council for further consideration.

Overseas

Eire.—DUBLIN.—The Electricity Supply Board is to erect a sub-station at North Richmond Street, Dublin. The Corporation is to pay £1,200 towards the cost.

France.—ELECTRICAL DEVELOPMENT IN THE SOUTH.—The report of the Sud Electrique Co. indicates that satisfactory progress is being made in the area served. Electrification of four additional towns was undertaken last year, bringing the total number supplied to 365, excluding forty-eight areas served by local companies which buy electricity from the Sud Electrique. The length of distribution lines was increased by 135 km. to 6,695 km.

Poland.—NEW POWER STATION.—A big power station is now being constructed at Stalowa Wola, a new industrial town built in the central industrial region, states *Reuter's Trade Service* from Warsaw. Since work started at the beginning of 1937, 380 transmission lines have been installed in the central region.

Switzerland.—PLEA FOR A "SQUARE DEAL."—The Geneva Société Générale pour l'Industrie Electrique in its annual report makes a plea for a "square deal" for the electrical industry. It is pointed out that electrical energy is coming to be recognised more and more as a primary necessity. Yet the industry has for the past few years been the butt of attacks which are considered to be as unjust as they are unreasonable. These campaigns have caused a panic among investors and this situation renders the financing of work increasingly difficult. The uncertainty as to the future, the decline of profits and the difficulty of obtaining money have in many cases obliged supply companies to put off the realisation of projects which could have provided new business and helped the improvement of economic activity.

COMMUNICATIONS

Great Britain.—TELEPHONE SYSTEM DAMAGED.—Four explosions occurred last week in inspection chambers of the telephone system at Coventry, and are attributed by the Chief Constable to a malicious attempt to disorganise the town's telephone service. More than 1,000 lines were affected, and in one of the explosions a passer-by was injured.

AUTOMATIC TELEPHONY.—In the House of Commons last week Sir A. Beit asked the Postmaster General when the Victoria telephone exchange, London, would become automatic, and when the conversion of the whole Metropolitan area would be completed. Major Tryon said that the Victoria telephone exchange would, it was hoped, be converted to automatic working next May. The conversion of the London telephone system, within a radius of 10 miles from Oxford Circus, would, in accordance with the present programme, be completed by about 1944.

TELEPHONE PROGRESS.—The Birmingham Telephone Area (telephone manager, Mr. J. L. Parry; superintending engineer, Mr. H. Faulkner) covers over 1,500 square miles and contains 171 exchanges. Last year the number of telephones in use increased by 6.8 per cent. to 137,298, and calls rose by 6.7 per cent. to 121.7 millions. New main automatic exchanges were opened at Birmingham Central (Telephone House) and Cannock, with conversions at six smaller exchanges. This year six more exchanges will be converted, and in anticipation of change to automatic working new buildings are being provided in thirteen places. It is expected that by the end of this year all automatic exchanges will have traffic recorders, which have proved an invaluable aid to administration by indicating the amount of plant required. The total cost of work carried out in exchanges in the Area during 1938 was approximately £214,000, besides which additional line plant and improvements cost £227,000. Expenditure on the provision of cables and ducts for trunk and junction purposes cost £125,000, and a similar amount was spent on repeater plant. For the training of operators it is proposed to open a new school at Birmingham to cater for the whole of the Midlands, to be ready by 1940.

In the North Midland District (superintending engineer, Capt. L. H. Harris, M.Sc.) the number of telephones increased by 8 per cent. to 143,789, and the number of local and trunk calls dealt with in the District rose by 15.7 per cent. to 108.3 millions. Great progress was made towards the mechanisation of the service, and at the end of the year 247 of the 399 exchanges had been converted to automatic operation, 37 new automatic exchanges being opened during 1938 (30 of the "unit" type). Further extensions of the main underground cable network in the district were effected by the provision of cables between Peterborough, Grantham, Spalding, and Boston, and from Spilsby to Skegness, Holbeach to King's Lynn, Leamington to Birmingham, and Stratford-on-Avon to Evesham and Cheltenham. In addition, new main junction cables were brought into use and the local underground cable network considerably extended.

Switzerland.—ADDITIONAL TELEPHONE CIRCUITS.—According to the *Journal des Telecommunications*, of Berne, a number of extensions to the telephone communication facilities between Switzerland and several European countries have recently been completed. A second circuit is now available between Basle and Rotterdam, a fifth between Basle and Paris, and a fourth between Basle and London. Between Geneva and Amsterdam a second circuit has been made available, a fifth between Zurich and Amsterdam, a second between Zurich and Brussels, and a direct connection has also been established between Zurich and Belgrade.

TRACTION

Eire.—TRANSPORT INQUIRY.—Both the Drumm Battery Co., Ltd., and the Electricity Supply Board have given evidence before the transport tribunal which is inquiring into the position of road and rail transport in Eire. The report of the tribunal is expected to be issued next month and it is anticipated that some of its recommendations may have far-reaching effects in the industry.

Glasgow.—TRAMWAY EXTENSION.—A Provisional Order is being promoted to authorise various works, including the extension of the tramways from Anniesland over the new Cloberhill bridge spanning the Forth and Clyde Canal, which is estimated to cost £46,000. This extension will be over a mile and a half in length, and the time for its completion is limited to three years. The Order reserves the right to the Transport Department to run trolley-buses on the route, as a substitution for tramways, if that is desired at any time.

Newcastle-on-Tyne.—TRANSPORT UNDERTAKING TO HELP RATES.—Despite opposition from the Transport and Electricity Committee, the City Council has decided to take £20,000 from the transport undertaking for the relief of general rates. The surplus on the transport undertaking for the year, it was stated, was £113,000.

South Shields.—TUNNEL UNDER THE TYNE.—A company named the North and South Shields Electric Railway, Ltd., Aldersgate Street, London, is applying to the Ministry of Transport for permission to build a railway tunnel under the Tyne between North and South Shields. The tunnel, it is stated, will be built on the Kearney system or other system approved by the Ministry.

Tenders for Floodlighting

AT last week's meeting of the London and Home Counties J.E.A. the Local Distribution Committee reported that its attention had been called to a proposal of Twickenham Corporation to floodlight the Hampton swimming bath, for which tenders were obtained by the Corporation from electric lighting contractors and from the Hampton Court Gas Co. After a comparison of prices for the installation and maintenance of the floodlighting, the Council decided to install gas lighting, the reason given being that, although the cost of installing electric floodlighting was less than that of gas, the maintenance charges in respect of gas were less. The committee had considered the comparative prices which were submitted to the Council for electric lighting, and found that, without any reference to the Authority, they were based upon the ordinary lighting flat rate. It considered that, as the comparisons quoted in the published report of the Twickenham Corporation were made without consultation with the Authority, they might prove misleading to the public, and accordingly asked the Corporation to furnish the Authority with further information concerning the proposal.

FINANCIAL SECTION

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

North and South Shields Electric Railway, Ltd.—Public company. Registered March 25th. Nominal capital, £1,000. Objects: To construct a railway in the County Boroughs of Tynemouth and South Shields, to equip and work railways, light railways and tramways, &c. Directors: E. Remnant, 3, Down Street, London; S. D. Herington, 8, Eton Villas, Hampstead; and H. R. Herbert, The Warren Fairway, Merrow, Surrey. Registered office: Alder House, Aldersgate Street, London, E.C.1.

Sterling Manufacturing Co., Ltd.—Private company. Registered March 24th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in machinery, electrical and mechanical and general engineers, radio experts and service agents, &c. Subscribers: K. M. Cole, 1, Jerningham Road, S.E.14; and Mrs. J. E. Jordan, 64, Brixton Hill Court, S.W.2. Solicitors: Cosmo Cran & Co., 5, Devonshire Square, E.C.2.

Vislok Engineering, Ltd.—Private company. Registered March 24th. Capital, £12,000. Objects: To acquire the goodwill and trade marks of "Vislok" and certain assets of the business of Vislok, Ltd., and to carry on the business of engineers, warehousemen, makers and sellers of electrical and engineering apparatus, &c. Directors: H. T. Appleton, "Woodhays," Cheyne Walk, Croydon; and W. Haddon, The Limes, Clipston, Market Harborough. Registered office: St. Brides House, 11, Salisbury Square, Fleet Street, E.C.4.

Freer Fans, Ltd.—Private company. Registered March 22nd. Capital, £2,000. Objects: To carry on the business of manufacturers of and dealers in fans, blowers, superchargers, ventilators, and air-conditioning apparatus, air screws and machinery and apparatus of all kinds, involving mechanical propulsion or extraction of air, &c. The life directors are: G. Freer and Mrs. V. Freer, both of 42, Hillcrest Avenue, Edgware. Solicitors: A. L. Philips & Co., 6, Holborn Viaduct, E.C.1.

Aro Twinsulation Batteries, Ltd.—Private company. Registered March 25th. Capital, £1,000. Objects: To acquire the business of an electrical engineer now carried on by T. W. White at 27, Clipstone Street, W.1, and to carry on the business of manufacturers, producers, hirers and repairers of and dealers in batteries, accumulators, dynamos, &c. T. W. White is first and permanent director. Registered office: 27, Clipstone Street, St. Marylebone, W.1.

Emradco, Ltd.—Private company. Registered March 23rd. Capital, £100. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus and accessories, radio sets and valves, &c. F. R. Samson, Broken Ridge, Oxshott Way, Cobham, Surrey, is the first director. Registered office: 69, Margaret Street, W.1.

Returns of Electrical Companies

Statements of Capital

Zenith Electric Co., Ltd.—Capital, £26,250 in 25,000 ordinary shares of £1 and 25,000 deferred shares of 1s. each. Return dated December 23rd, 1938. 25,000 ordinary and 23,334 deferred shares taken up. £5,563 paid on 5,563 ordinary shares, £20,603 14s. considered as paid on 19,437 ordinary and 23,334 deferred shares. Mortgages and charges nil.

Price's Electrical Supplies, Ltd.—Capital, £3,000 in £1 shares. Return dated October 27th (filed December 30th), 1938. 1,210 shares taken up. £1,210 paid. Mortgages and charges, nil.

St. Mary's (Scilly) Electricity Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated December 8th, 1938. 10,452 shares taken up. £7,435 paid. £3,017 considered as paid. Mortgages and charges, £4,550.

A.F.A. Accumulators, Ltd.—Capital, £5,000 in £1 shares. Return dated December 12th, 1938. All shares taken up. £1,251 paid. £3,749 considered as paid. Mortgages and charges, nil.

Robinson & Hands Electric Co., Ltd.—Capital, £5,000 in 20 ordinary and 4,980 preference shares of £1. Return dated December 19th, 1938. 20 ordinary and 4,232 preference shares taken up. £4,252 paid. Mortgages and charges, £8,000 deb. to bank.

Vaughan Crane Co., Ltd.—Capital, £150,000 in 50,000 preference and 100,000 ordinary shares of £1. Return dated December 28th, 1938. 16,880 preference and 53,578 ordinary shares taken up. £43,669 paid. £26,789 considered as paid. Mortgages and charges, nil.

Peerless Electrical Manufacturing Co., Ltd.—Capital, £50,000 in 46,500 ordinary shares of £1 and 70,000 deferred shares of 1s. Return dated December 30th, 1938. 37,500 ordinary and 48,368 deferred shares taken up. £37,896 10s. paid on 36,000 ordinary and 45,368 deferred shares, leaving £371 18s. calls unpaid. £1,650 considered as paid on the remainder. Mortgages and charges, £39,546 10s.

Mortgages and Charges

Criterion Electric, Ltd. (formerly Criterion Radio Products, Ltd.).—Satisfaction to the extent of £100 on January 26th, 1939, of debenture registered May 16th, 1933.

Fullick & Loosley, Ltd.—Charge on moneys due to the company under a certain agreement, dated March 17th, 1939, to secure £1,251 14s. 2d. Holders: Falk, Stadelmann & Co., Ltd., 83/93, Farringdon Road, E.C.1.

Reports and Dividends

British Insulated Cables, Ltd., held its annual meeting on March 28th when Sir Alexander Roger (chairman), who presided, in referring to the capital expenditure during the year under review, said that it represented the progress in many mechanical forms and enabled them to continue to pursue the policy of widening their range of products as much as possible. In the latter connection he would particularly mention the progress made during recent years in the manufacture of railway and trolley-bus overhead equipment, fittings, meters, condensers, electric welders and moulding machines. Although the manufacture of cables remained their principal business, the widening of the base tended to make them less and less dependent on the fluctuations in turnover and profit rate inherent in the cable business.

The past year's trading showed a contraction in sales and in the volume of output compared with the previous year. Trading conditions were not easy, and selling prices continued to show a downward trend. Industry suffered generally from the disquieting international political situation. That the fall in profits was so small was due to the increased efficiency in their factories, economies, improvements, and the work of all grades of employees. With regard to the contract received from the L.N.E.R. for the overhead and track equipment from Manchester to Sheffield and also in the neighbourhood of Liverpool Street, London, they were just about to commence delivery of material to the sites. Their subsidiary, British Copper Refiners, Ltd., continued to give excellent results both in the matter of quality of output and in the financial results of its trading.

With regard to export trade circumstances affecting world business were changing rapidly, and it was dangerous to express views based on facts as we knew them to-day in case entirely fresh considerations arose to-morrow which might have the effect of nullifying everything that preceded it. The only sure road to peace was by way of universal trade on a basis which permitted the easy and rapid passage of goods between all countries. But if present political conditions developed on the lines being pursued by certain Continental countries the consequence would be to set up fresh barriers between nations far higher and more insurmountable than any tariffs yet designed.

In Empire business, the result of Continental policy had determined the Dominions and Colonies to pursue a policy of developing secondary industries for the purpose of making available to themselves goods manufactured within their own borders and with little regard to the large purchases which this country made from them. They had been forced under these conditions to take up interests in manufacturing concerns similar to their own in various Dominions. They did not pursue this policy alone. These interests had been acquired jointly with other members of the Cable Makers' Association. As a contrast to this tendency they had recently secured an important contract for super pressure cables from the Johannesburg Municipality, having a value of about £200,000.

The British Aluminium Co., Ltd.—Presiding at the annual meeting held on March 28th Mr. R. W. Cooper (chairman) said that the increased profit for 1938 was consequent upon the output of aluminium of the company and of its subsidiary companies having reached a new high record, coupled with the sale of a considerably larger tonnage than in the preceding year. The present programme of enlargement of the Lochaber works was now completed, as were also the extensions of the Burntisland alumina works. The erection and equipment of the new alumina works at Newport, Mon, had been proceeded with and production was scheduled to commence next month. Additions to the rolling mills were carried out during the year and further extensions were still in progress. The company formed in Australia, in association with others, was now erecting a rolling mill in that country, and in partnership with others they were now engaged in providing plant in India.

They had taken a participation in a company formed with the object of producing aluminium in South Wales. This was a comparatively small development, and as power was to be generated by the use of coal it could not operate as economically as their hydro-electric undertakings. The third and last stage of the civil engineering works at Lochaber still remained to be constructed, and Royal Assent was obtained in July of last year to a Bill confirming a Provisional Order which was promoted by the Lochaber Power Co. Under the terms of this Act they had been given a further seven years in which to commence and complete these works.

The consumption of aluminium on the electrical side continued satisfactory, particularly for overhead transmission lines. Development also continued in the use of aluminium for bus-bars for the distribution of electricity for light and power in large buildings. The use of insulated aluminium cable in aircraft where weight saving was of particular value was a comparatively recent development which would be of increasing importance as aircraft became larger and more complicated.

The Lancashire Dynamo & Crypto, Ltd., held its annual meeting on March 28th, when Mr. H.W. Bosworth (managing director) said when dealing with the subsidiary companies that the Foster Engineering Co., Ltd., had shown a satisfactory profit for 1938, and had contributed to the profits of the parent company. Numerous developments had been made at the Foster works and its range of switchgear had been greatly extended. Business had improved very greatly during the last

five months with the Crypto Equipment, Ltd., which dealt principally with the motor-car industry. Dynamo & Motor Repairs, Ltd., and Ferrous Light Castings Co., Ltd., both had a satisfactory year and had paid good dividends. Their Canadian associate, Bepco Canada, Ltd., was also operating at a profit and they received a substantial dividend from it during 1938. The company's works both at Manchester and Willesden commenced 1938 with record order books and their production for the year had exceeded the previous record obtained in 1937. The food machinery section at Willesden had developed and had also had a record year. During 1938 the amount of new business available gradually decreased. The first three months of 1939, however, had shown a revival of trade.

The Clyde Valley Electrical Power Co. held its annual meeting on March 28th, when Mr. C. Ker (chairman), who presided, said that the sales for 1938, 464,000,000 kWh, showed an increase over 1937 of 33,000,000 kWh, of which increase 25,000,000 kWh was for industrial and bulk supplies and 8,000,000 kWh for domestic purposes. These figures were exclusive of the net export of 125,000,000 kWh to the Central Electricity Board. The average rate per kWh for 1938 received from consumers was 0.6757d. and the combined average rate of the company and its subsidiary was 0.7573d., which compared with 0.6487d. and 0.7379d. per kWh, respectively, for 1937. 13,000 new consumers were added during 1938, bringing the total supplied directly by the company and its subsidiary, the Strathclyde Co., up to 159,000.

The Richmond (Surrey) Electric Light & Power Co., Ltd.—Presiding at the annual meeting on March 28th, Sir Robert Renwick, Bart. (chairman), said the year 1938 had not been without its difficulties and was one of the mildest on record. It was estimated that some 75,000 to 80,000 kWh was lost to the company owing to the unfortunate breakdown experienced at Kingston by the authority from whom they derived a bulk supply. However, the sales of electricity to consumers had increased to 13,954,902 kWh, as against 12,862,762 kWh in 1937, an increase of 8.5 per cent. The development of the domestic field in their area continued to be successful, and they had gone out to establish their supply in the smallest type of house and had succeeded in this against the competition of the gas industry. The average rate of the domestic two-part tariff was 1.16d. per kWh and there was no question that the benefits of electricity had been appreciated.

The Midland Electric Corporation for Power Distribution, Ltd., reports a net profit for 1938 of £160,174, as compared with £146,033 for 1937, to which is added £49,048 brought in, making £209,222. After providing for debenture and loan interest, &c., it is proposed to pay a final ordinary dividend of 6 per cent., making 9 per cent. for the year (same) and to carry forward £50,202. During the year 7,374 new consumers and 20,102 kW of additional load were connected to the mains. The annual meeting was held on March 28th when Mr. G. H. Nisbett (chairman), who presided, said that tariffs had been unaltered throughout the year. They were one of the few companies who had borne the increases due to fuel costs and wages without any adjustment in the charge to consumers. During the year they connected 7,427 new consumers and 21,366 kW of additional load, the greater part of which was for lighting and domestic supplies. This was the first year in which the lighting and domestic load connected had exceeded that for power.

A number of electric furnaces, representing 12,000 kW of demand, were either installed on their mains or were in course of installation. The output for 1939 so far showed a substantial increase above the early months of last year, and bearing in mind the fall that occurred in the autumn of 1938 due to the crisis, prospects for 1939 appeared to be good. During the year they assisted domestic consumers to the extent of £21,833 with hire-purchase commitments, while payments on previous installations were £29,661. They expected to increase their commitments considerably this year by a cooker campaign which was now in progress.

Arrangements had now been made with the West Midlands J.E.A. for a second feeding point from the grid, which would assist in security from interruption due to possible air raid damage and in meeting additional demands. From this new grid point 33 kV mains would be run so as to give independent feeds into their northern and southern areas.

The North-Eastern Electric Supply Co., Ltd., held its annual meeting on March 22nd when Mr. R. P. Sloan (chairman), who presided, said that the company had now completed the fiftieth year of its existence. In view of the satisfactory trading results obtained last year, they were again making a reduction in their charges for electricity supply to certain classes of consumers. They had this year opened a general reserve and it had been started by a transfer of £100,000 from the year's profit. During the year under review they had secured 21,766 new customers, which was substantially in excess of the previous year's figures, and was mainly represented by domestic customers. Bearing in mind that their area of supply was already highly electrified, this increase reflected credit on all concerned in obtaining this class of business.

In spite of continued increases in the cost of coal they were making further reductions in the charges to a large number of their lighting and domestic customers as from the beginning of next quarter. These reductions would chiefly benefit the small householders who took their supplies through prepayment meters. The reductions in charges to lighting and domestic consumers which they had made between 1935 and 1938 had averaged £50,000 per annum.

As regards their supplies to collieries, shipyards, engineering works, and iron and steel works, the past year proved to be satisfactory. The same might also be said in respect of their business with the lighter industries. The new 50,000-kW turbo-alternator installed at Dunston "B" power station was now in commercial operation and the boilers would be ready in the near future. Work was also in hand to provide for the reconstruction of an existing turbo-alternator at the Dunston "A" station which, when completed, would enable the machine to give an output of 15,000 kW to assist in meeting anticipated increased demands next winter.

In 1938 they made appreciable progress in the outlying rural areas and fifty-seven new distribution centres were established. They had in hand still further extensions into sparsely populated localities. The number of farm premises, where supplies were now being taken from them, exceeded 1,000.

The Telephone & General Trust, Ltd., held its annual meeting on March 22nd when Sir Alexander Roger (chairman), who presided, said that the Anglo-Portuguese Telephone Co. continued to expand, and the growth during 1938 of 8 per cent. in the number of stations represented the largest annual addition in the history of that company. The Nacional Co. of Venezuela had at the end of the year a system covering 14,973 lines. A capital expenditure of £100,000 was undertaken during the year, and it was anticipated that further large sums would have to be spent. The Jamaica Telephone Co. operated 5,323 stations, the growth during 1938 being at the rate of 18 per cent.

Although the Barbados Telephone Co. had shown a growth of 9 per cent. in telephone stations, progress was slow. Trinidad Consolidated Telephones had at last been granted an extension of concession of nearly twenty years by the Government of Trinidad. During the negotiations capital expenditure had necessarily been restricted, but in spite of this the company had experienced a station growth of 11 per cent. during the year. They now proposed to go forward with development wherever it was economically possible.

Sangamo Weston, Ltd., reports a net profit for 1938 of £77,094, as compared with £59,341 in the previous year, to which is added £60,832 brought in. The ordinary dividend for the year is maintained at 15 per cent., general reserve receives £30,000, and £85,426 is carried forward. The report states that negotiations for the acquisition of the remainder of the issued capital of the Weston Electrical Instrument Co. have now reached a conclusion, but to bring this about it has been necessary to agree to increase the consideration from 12,000 to 15,000 shares of 10s. of the company credited as fully paid. This necessitates a further small increase in capital, and it is proposed that the authorised capital be increased to the round amount of £160,000. Meeting: March 31st.

The Bournemouth and Poole Electricity Supply Co., Ltd.—Sir Robert Renwick, Bart. (vice-chairman), who presided at the annual meeting on March 28th, said that for many gas and electricity undertakings 1938 had been a bad year. Their sales had, however, increased by 7,824,831 kWh to a total of 66,593,315 kWh, an improvement of 13.3 per cent. over 1937. Bearing in mind the abnormal circumstances of the year under review, the position disclosed was, he thought, satisfactory, and for the first two months of this year there was an increase of 14.1 per cent. in the number of kWh sent out as compared with the corresponding period of last year. The two-part tariffs continued in popularity, and last year there was an increase of 5,786 consumers and the sales amounted to 33,068,569 kWh as against 28,120,766 kWh for 1937, an increase of 17.6 per cent. Despite the increased costs of raw materials they had again been able to make reductions in charges in certain parts of their area, in one case in the flat rate for lighting, and in another in the two-part tariffs, but the increased costs would result in postponing further reductions to their consumers. With the obtaining of the contract for street lighting from the Christchurch Corporation, all three boroughs, Bournemouth, Poole and Christchurch, had now adopted electricity for main-road lighting. Another 3,060 new consumers had been connected to their mains during the year, and they had added 26 miles of high voltage lines and 85 miles of low voltage lines.

The South London Electric Supply Corporation, Ltd.—Presiding at the annual meeting held on March 22nd Lord Gainford (chairman) said that their area, being largely industrial, felt the effects of the general slackness during the year under review, but nevertheless there was an increase in output of over 7 per cent. and in receipts from the sale of electricity of 5.7 per cent. They were in close association with the County of London Electric Supply Co., Ltd., and he had mentioned before the value to their company and their associated companies of obtaining uniform rates for supply throughout the large area served, and that uniformity had stood them in good stead. While all around them various electricity and gas undertakings were increasing their prices, it was some consolation to know that they had no need to make any increase of price to their consumers.

The Mersey Power Co., Ltd.—At the annual meeting on March 24th it was reported that the Percival Lane power station was being extended by the erection of three 30,000-kW sets at an estimated cost of £1,500,000, work on which was due for completion in 1941. During 1938 the company laid thirty-four miles of cable, erected twenty-two new sub-stations. 1,963 new consumers had been connected, and 839 cookers had been sold or hired. Domestic consumers had taken 1,608,000 more kWh and the company's sales had increased by 1,188,000 kWh. There was a decrease in the power sales due to the unsettled industrial conditions. A resolution was passed authorising the directors to borrow as and when and upon such terms as they think fit £1,500,000 in excess of the amounts they are at present authorised to borrow.

The Mid-Cheshire Electricity Supply Co., Ltd.—Presiding at the annual meeting held on March 24th Col. J. A. Saner (chairman) said that sales of electricity during 1938 had increased by 2,000,000 kWh. The increase in the use of electric cookers had continued unabated, and there were now 2,090 cookers and 4,159 breakfast cookers in use, which was practically equivalent to one for each two domestic consumers. Their overhead system now extended to every parish and there were 626 farms connected out of 1,083 in Mid-Cheshire. High-voltage branch lines were now being erected to serve some of the most remote farms. They provided electrical installations and apparatus on hire, or hire purchase, on favourable terms.

The Electrical Distribution of Yorkshire, Ltd.—Presiding at the annual meeting on Monday last, Mr. R. W. Wickham (chairman) said that during the past ten years they had expended £2,064,271 on the extension of their system of supply. In that time they had obtained 89,000 new customers, and

they had, due to the operation of their two-part tariffs, charged year by year a lower average price for electricity so that to-day it was 18 per cent. less than it was ten years ago, notwithstanding the fact that practically every item of costs had increased. The supply of electricity for domestic purposes continued to be their principal business, and the addition of 12,154 new consumers during the year indicated its rapid expansion. They had made further contracts for electric street lighting and for commercial and industrial supplies, and the prospects for the current year were encouraging.

The Marconi International Marine Communication Co., Ltd., has announced a final dividend of 5 per cent., making 7½ per cent., less tax, for the year (same), plus a cash bonus of 2½ per cent. (nil). The net profits for the past year were £139,790, an increase of £24,946 as compared with 1937.

The Oriental Telephone & Electric Co., Ltd., reports a net profit for 1938 of £117,731, as against £114,147 for 1937. The final divideid is 8 per cent., tax free, making 12 per cent. for the year (same).

Associated Electrical Industries, Ltd., reports a profit for 1938 of £1,399,499, as compared with £1,290,008 for the preceding year, from which is deducted depreciation written off works, machinery, plant, &c., £229,934, and income tax and N.D.C. £505,257, leaving £664,308, which with £220,015 brought in makes £884,323. Special reserve receives £100,000 and dividend equalisation account £100,000. The ordinary dividend is maintained at 10 per cent. for the year and £251,647 is carried forward. The report states that the inflow of orders during 1938 was greater than in any previous year except 1937. All the works of the group were fully employed and the output was the highest in the history of the company. The unexecuted orders on hand at the end of the year were slightly less than at December 31st, 1937. Meeting: March 30th.

A. Reyrolle & Co., Ltd., report a net profit for 1938 of £187,476, as compared with £155,322 for 1937, which with £144,233 brought in makes £331,709 available. Development expenditure absorbs £40,000 and general reserve £39,807. The ordinary dividend for the year is maintained at 12½ per cent. by the final payment of 7½ per cent., and £142,638 is carried forward. The share capital was increased during the year by the issue of 36,711 ordinary shares in connection with the reconstruction of Parolle Electrical Plant Co., and the transfer to the company of 2,104 shares of £100 each in C. A. Parsons & Co. The company holds 25,000 £1 shares in the Parolle Co. The report states that orders received in 1938, although less than in 1937, were maintained at a satisfactory figure, and the sales of the company's productions were increased. Substantial orders are in hand for the Government.

The Anglo-Portuguese Telephone Co. reports a net profit for 1938 of £78,967, as compared with £78,013 for the preceding year, to which is added £28,768 brought in. The final ordinary dividend is 5 per cent., making 8 per cent. for the year (same), and a dividend of 8 per cent. (same) is paid on the "A" shares. The balance carried forward is £32,371. Meeting: April 5th.

Allen West & Co. report net profits for the year to January 31st of £101,049, as compared with £63,736 for 1937-38. General reserve receives £35,000, and it is proposed to pay an ordinary dividend for the year of 7½ per cent. (same), plus a cash bonus of 2½ per cent. (against nil). The balance carried forward is £53,500 (against £36,200 brought in).

Heenan & Froude, Ltd., are paying an interim dividend of 5 per cent., less tax (same).

Heatrae, Ltd., has announced a first and final dividend of 12½ per cent. (against 12 per cent.).

The Southern Areas Electric Corporation is maintaining its dividend for 1938 at 5 per cent. by a final payment of 3 per cent.

The North Somerset Electric Supply Co. is paying a first and final dividend of 7 per cent., less tax (same).

The Montreal Light, Heat & Power Consolidated is paying a quarterly dividend of 37 cents per common share to March 31st (same).

Joseph Lucas, Ltd., have announced an interim ordinary dividend of 2½ per cent. (same).

Stocks and Shares

TUESDAY EVENING.

"SELL your British stocks and buy American" was advice frequently heard not so very long ago. There were people who acted on it. The process became accelerated by the flight from the franc. The present-day flow of gold into the United States suggests that the policy still has adherents. Nevertheless, the course of share quotations in Wall Street can hardly have flattered the majority of investors who made the experiment. Instead of Wall Street moving on a pivot of its own, the American market is greatly influenced by the developments of the Rome-Berlin Axis. Illogical it may be, but it is a patent fact that American prices, industrial, rail-road and mining, are closely affected by European news.

Markets and Crises

Where the Stock Exchange stands to be chiefly disadvantaged by the latest crisis is through the fresh blow that it has dealt to public confidence and public readiness to use money in the purchase of stocks and shares. Budget date, April 25th, is in itself a warning of what the Chancellor may have in store for the taxpayer. Increased burdens upon capital are assumed to have an inevitable sequel in the way of prices being lowered in many of the markets. On top of this is the vague apprehension of further swift moves on the Continent. Faced with these considerations, neither investment nor speculation is encouraged to deal. Markets are so quiet that business may be said to have dwindled to a trickle. To go through a day without doing a solitary bargain is not, for some members of the House, as uncommon an experience as it is unpleasant. In such circumstances, the inclination of prices is bound to be against holders of securities.

London Transport "C" Stock

If the London Transport Board and the main-line railway companies succeed in the proposal for an increase of about 5 per cent. in London fares, the result might put an altered complexion on the earning capacity of the Transport Board. This is the general impression given so far by the evidence in the claim now before the Railway Rates Tribunal. Under the present arrangement, the receipts from traffic in the London area are pooled, and shared out in the proportion of 62 per cent. to the Board and the balance to the four railways. On the proposed revision of fares, the receipts of the pool would be likely to rise by £1,179,000, of which £732,000 would go to the Board. Last year the Board's net receipts were about £617,000 short of the amount required to pay the standard 5½ per cent. dividend. This explains why the Board now stands exposed to the application for a receivership.

Industrial Markets

The new confidence which, up to the time of the latest trouble, had been venturing more openly into the investment field, shows signs of reasonably hardy constitution. The extent of the recoil is considered to have been not excessive in relation to the force and unexpectedness of the blow. It is pointed out, for instance, that the general level of industrial share prices is still above the depression of the end of January. Yet at that time apprehension was concerned only with the possibility of what has now actually happened. By way of explanation, it is suggested that confidence has not so much retreated as shifted its ground. According to some, the disappearance of the appeasement hopes is partially counterbalanced by the fresh compulsion to strengthen the national defences. The assurance of heavy Government expenditure on this account is held to be the best assurance of peace and, simultaneously, of active trade in many sections of industry. Vickers, after being harder, reverted to their previous price of a guinea.

Communication Stocks

Cable and Wireless stocks continue to show weakness, the preference and ordinary both being 3 points lower at 81½ and 41½ respectively. This is reflected in a decline to 25s. in Globe Telegraph preference and ordinary shares. The Continental ferment is responsible for a fall of 3 in Great Northern Telegraphs. The price is now 31½, lower than it has been for some years past. Anglo-Portuguese Telephone, at 22s. 6d., are 6d. lower, in spite of a satisfactory annual report showing earnings on the capital of nearly 8½ per cent. gross. The dividend is maintained at 8 per cent. less tax. That the company is going ahead can be seen from the fact of 3,672 new stations having been added in 1938. Anglo-American Telegraph stocks failed to make any recovery after their previous weakness. In the dollar stocks, a recovery of 5 points in American Telephone and Telegraph has lifted the price to 170½, but International "Tel. & Tel." has receded to 8½. Marconi Marines remain at 27s., unaffected at present by the increase, to 10 per cent., in the dividend, an improvement of 2½ per cent.

Equipment and Manufacturing

The favourableness of the comparison, noted above, between industrial share prices now and at the time of the previous outbreak of nerves, is well in evidence in the market for electrical equipment and manufacturing shares. Among the leaders, General Electrics, even after a fall of more than 4s., are still 6s. 3d. above the price of 70s. 9d. which they touched in January. At about that time Associated Electrical Industries were down to 34s. 9d., as compared with 40s. now; Callenders Cables to 70s., against 81s. 3d.; Crompton Parkinsons to 15s., against 18s. 9d. Johnson & Phillips at 37s. 6d. stand 5s. 6d. above their recent lowest price, and British Aluminiums at 53s. 9d. are 5s. higher. This state of affairs doubtless owes a good deal to the excellent figures shown in the recent annual reports of a number of electrical manufacturers, including English Electric, Associated Electrical, Ericsson Telephone and Lancashire Dynamo.

Miscellaneous Matters

The annual report shows that the Reyrolle Company has again done extremely well, net profits being £32,000 up, at £187,500. The profits have been increasing for the past five years. At 57s. 6d., the shares give a return of £4 6s. 10d. per cent. on the money, without making allowance for the dividend of 1s. 6d., less tax, now accrued in the price. Allen West is another company to publish highly satisfactory figures. The net earnings are nearly 75 per cent. better than those of a year ago. The previous dividend of 7½ per cent. is supplemented by a bonus of 2½ per cent. At 6s. 9d. the price is unchanged on the week. The yield on the 10 per cent. distribution is nearly 7½ per cent. on the money.

Whitehall Electric Investments controls the West of England Electric Investments, which latter company has just increased its capital to £850,000 by the creation of 100,000 £1 shares. The company's 3½ per cent. debenture stock is quoted at 95: the shares are not dealt in in the market. South Wales 5 per cent. debenture stock, it may be added, stands at 103.

ELECTRICAL COMPANIES' SHARES

Prices, dividends and yields

Company	1938 High-est	1938 Low-est	Dividend Pre-vious	Dividend Last	Price Mar. 28	Rise or Fall	Yield £ s. d.
Home Electricity Companies							
Bournemouth and Poole	68/3	62/–	15	15	65/9	—	4 11 2
British Power & Light	30/9	24/6	7	7	29/6	–9d.	4 15 0
City of London	34/6	28/6	7½	7½	32/6	—	4 13 9
Clyde Valley	42/6	33/–	8	8	35/9	+9d.	4 9 4
County of London	51/9	38/9	10½	10½	43/6	—	4 16 7
Edmundson's:							
7% Pref.	33/3	30/–	7	7	30/6	—	4 11 10
Ord.	40/9	18/9	9	9	25/–	—	—
Elec. Dis. Yorkshire	43/6	37/9	9	9	40/–	—	4 10 0
Elec. Fin. and Securities	51/9	49/–	12½	12½	47/6	—	5 5 3
Elec. Supply Corporation	55/–	50/–	12	12	51/3	—	4 13 7
Isle of Thanet	21/3	18/6	4	4	18/6	—	4 6 6
Lancs Light and Power	35/–	26/–	7½	7½	32/6	—	4 12 4
Llanelly Elec.	23/6	21/–	5½	5½	21/6	—	5 2 4
Lond. Assoc. Electric	32/9	28/–	7	7	28/9	—	4 17 4
London Electric	36/3	32/–	7	7	33/–	—	4 4 10
London Power Deb. Red.	108¾	100	5	5	103½	—	4 16 6
Metropolitan	51/–	41/–	12	12	48/3	–6d.	4 19 6
Midland Counties	39/9	33/–	8	8	37/–	—	4 6 6
Mid. Elec. Power	41/9	37/–	8	9	38/9	—	4 13 0
Newcastle Elec.	31/9	27/6	7	7	28/9	—	4 17 4
North Eastern Electric:							
Ordinary	34/–	25/–	7	7	30/–	–1/–	4 13 4
7% Pref.	34/–	30/–	7	7	31/–	—	4 10 4
Northampton	47/6	43/9	10	10	47/6	—	4 4 2
Notting Hill 6% Pref. (£10)	14½	13½	6	6	13½	—	4 15 9
North Met. Elec.:							
Ordinary	49/–	43/–	10	10	45/–	—	4 9 0
6% Pref.	30/6	28/3	6	6	28/–	—	4 5 9
Richmond Elec.	30/6	28/–	7	7	28/9	—	4 17 5
Scottish Power	38/9	32/–	8	8	35/–	—	4 11 6
Southern Areas	22/9	18/6	4½	5	21/6	—	4 13 0
South London	32/6	31/–	7	7	29/6	—	4 15 0
West Devon	23/3	21/3	5	5	1½	—	4 9 0
West Glos.	19/–	16/9	2	2	20/–	—	2 0 0
Yorkshire Elec.	42/–	36/9	8	8	36/6	—	4 7 6
Overseas Electricity Companies							
Atlas Elec.	4/6	2/6	Nil	Nil	3/–	—	—
Calcutta Elec.	44/3	36/3	12*	10*	37/6	—	5 6 7
Cawnpore Elec.	40/–	35/–	10	10	31/3	—	6 7 10
East African Power	28/3	22/6	7	7	25/–	—	5 14 0
Jerusalem Elec.	26/9	23/3	5	6	24/–	—	5 0 0
Kalgoorlie (10/–)	12/–	9/6	7½	7	10/3	—	7 6 4
Madras	34/6	28/9	8*	8	30/–	—	5 6 8
Montreal Power	31¾	26½	1½	1½	32½	–¾	—
Palestine Elec. "A"	31/9	27/–	7½*	7½*	26/3	—	5 14 3
Perak Hydro-electric	25/3	17/–	7	6	17/6	—	6 17 2
Shawinigan Power	23½	16½	85cts.	83cts.	21½	—	—
Tokyo Elec. 6%	65½	39	6	6	54½	–1	11 0 2
Victoria Falls Power	76/3	55/–	12	13½	67/6	—	4 0 4
Whitehall Investments Pref.	22/3	15/–	7½	7½	17/6	–1/6	8 11 6
Public Boards							
Central Electricity:							
1950–70	115¾	97	5	5	108¾	—	4 12 2
1955–75	118½	100	5	5	110⅜	—	4 10 6
1951–73	111	95	4¾	4½	105½	—	4 5 4
1963–93	101	85	3½	3½	92½	—	3 14 10
London Elec. Trans. Gtd.	93½	88	2½	2½	87	—	2 17 1
London & Home Counties, 1955–75	112¾	97½	4½	4½	107	—	4 4 1
Lond. Passenger Transport:							
A	119½	104¾	4½	4½	110	—	4 1 10
B	122¾	105	5	5	110	—	4 11 0
C	84	68	4¼	4	71½	–2	5 12 0
West Midlands Joint Elec., 1948–68	115½	102½	5	5	109½	—	4 11 3
Telegraph and Telephone							
American Tel. & Tel.	160	114	9	9	170½	+5	5 5 9
Anglo-Am. Tel.:							
Pref.	115½	100½	6	6	97½xd.	–1	6 3 1
Def.	28	23	1½	1½	21	—	7 2 10
Anglo-Portuguese	23/6	19/3	8	8	22/6	–6d.	7 2 1
Cable & Wireless:							
5½% Pref.	104	76½	4½	5½	81½	–3	6 15 0
Ord.	67¾	34	—	4	41½	–3	9 12 10
Income	102½	99	—	—	99	—	4 1 0
Canadian Marconi $1	6/6	3/9	—	Nil	4/–	—	—
Globe Tel. & Tel.:							
Ord.	32/6	26/3	5½*	7½*	25/–	–1/6	6 0 0
Pref.	27/6	23/9	6	6	25/–	–1/6	4 16 0
Great Northern Tel. (£10)	42½	34	20	20	31½	–3	6 7 0
Inter. Tel. & Tel.	12½	5¾	Nil	Nil	8½	–¼	—
Marconi-Marine	30/6	21/6	10	10	27/–	—	7 8 3
Oriental Telephone Ord.	59/3	2½	12*	12*	2½	—	4 16 0
Radio Corpn.	9½	4¾	8	6	7½	–¼	—
Telephone Props.	13/9	11/3	5	6	13/9	—	8 14 6
Telephone Rentals (5/–)	10/–	7/6	5	6	9/–	—	3 6 8
Western Union	34½	17	2¾	—	22½	—	—
Traction and Transport							
Anglo-Arg. Trams:							
First Pref.	11/–	2/6	Nil	Nil	6/3	—	—
4% Inc.	31	8	Nil	Nil	12	—	—
British Electric Traction:							
Def. Ord.	1060	675	5	6	850	—	—
Pref. Ord.	175	150	8	8	160	—	5 0 0
Bristol Trams	45/–	34/3	8	10	43/9	—	4 11 2
Brazil Traction	14⅝	7⅛	$1	—	10⅝	—	—
Calcutta Trams	26/9	21/6	8	8	24/6	–6d.	6 10 8
Cape Elec. Trams	18/6	15/6	5	6	17/6	—	6 17 2
Lancs Transport	35/3	29/3	10	10	35/–	—	5 14 3
Mexican Light:							
1st Bonds	39	16½	5	5	25	—	—
Rio 5% Bonds	91	47	5	5	75	—	6 13 4
Southern Rly:							
5% Prefd.	87	48	5	5	62½	–2½	8 0 0
5% Pref.	116	83	5	5	90½	–1	5 10 6
T. Tilling	60/–	36/6	10	10	2½	–⅛	4 14 1
Tilling & B.A.	57/–	46/–	10	9*	52/6	—	3 8 7
West Riding	46/3	30/6	10	10	33/9	–⅛	—
Equipment and Manufacturing							
Aron Electricity Ord.	40/3	31/–	15	15	31/3	—	9 12 0
Assoc. Elec.:							
Ord.	45/3	32/–	10	10	40/–	—	5 0 0
Pref.	38/9	35/6	8	8	35/6	—	4 10 0
Automatic Telephone & El.	43/–	35/–	10	12½	42/6	—	5 17 9
Babcock & Wilcox	44/–	32/6	10	10	40/–	+6d.	5 0 0
British Aluminium Ord.	54/–	40/–	10	12½	53/9	+⅛	4 13 0
British Insulated Ord.	95/9	77/–	20	20	4⅛	–⅛	4 18 6
British Thermostat (5/–)	16/–	9/–	17½	18½	13/9	+⅛	6 14 6
British Vacuum Cleaner (5/–)	35/9	27/–	40	40	20/–	–2/–	—
Brush Ord.	5/6	4/9	Nil	Nil	5/–	—	—
Callender's	5⅛	78/6	20	20	81/3	—	4 18 9
Chloride Elec. Storage	77/9	61/–	15	20	80/–	—	5 0 0
Consolidated Signal	116/–	75/–	36½	36½	85/–	—	8 11 9
Crabtree (10/–)	29/–	22/–	17½	17½	23/9	–⅛	7 7 4
Crompton Parkinson:							
Ord. (5/–)	32/3	18/9	12½	15	18/9	+⅛	—
E. K. Cole (5/–)	8/9	4/6	5	10	6/6	+6d.	7 13 10
Elec. & Musical Industries (10/–)	16/3	9/–	10	5	11/6	–6d.	4 7 0
Electric Construction	36/–	31/–	10	12½	35/–	—	7 2 10
Enfield Cable Ord.	5⅝	46/–	25	16½	52/6	—	6 3 10
Electrical Switchgear (10/–)	27/–	22/6	16	16	26/9	—	5 19 8
English Electric	33/–	24/6	10	10	32/–	—	6 5 0
Ensign Lamps (5/–)	14/3	11/3	—	25	14/–	—	8 18 6
Ericsson Tel. (5/–)	2⅜	31/-	25*	25*	38/9	—	3 4 6
Ever Ready (5/–)	26/3	16/6	45	35	22/3	—	7 17 4
Falk Stadelmann	34/3	27/–	10	10	25/–	—	8 0 0
Ferranti Pref.	27/6	25/–	7	7	24/–	—	5 16 8
G.E.C.:							
Pref.	34/–	31/3	6½	6½	30/–	—	4 6 8
Ord.	79/3	67/–	17½	20	77/–	–1/–	5 4 0
Greenwood & Batley	27/6	19/–	7	15	26/3	—	11 8 2
Hall Telephone (10/–)	24/6	18/3	15	15	20/–	—	7 10 0
Henley's (5/–)	21/–	16/–	15	20	20/–	—	5 0 0
4½% Pref.	23/–	22/–	4½	4½	22/6	—	4 0 0
Hopkinsons	40/–	32/6	10	12	42/6	+6d.	5 13 0
India-Rubber Pref.	21/9	20/3	5½	5½	21/3	—	5 3 6
Intl Combustion	5/8	4½	32½	32½	5⅜	—	7 3 6
Ismay Industries (5/–)	6/9	1/–	6	6	9d.	—	—
J. Lucas	57/9	47/6	15	15	57/6	+⅛	5 4 1
Johnson & Phillips	43/9	32/6	10	12½	37/6	—	6 13 6
Lancashire Dynamo	72/3	53/–	20	25	65/–	—	7 14 0
Laurence Scott (5/–)	12/–	9/–	7	15	11/3	–6d.	6 13 4
London Elec. Wire	35/–	28/3	12	7½	30/–	—	5 0 0
Mather & Platt	49/–	41/3	13½	13½	48/3	+9d.	5 12 0
Metropolitan Elec. Cable Pf.	22/–	21/–	5½	5½	21/3	—	5 3 6
Murex	93/9	66/3	20	20	75/–	–⅛	5 6 8
Pye Deferred (5/–)	12/–	8/–	5	25	10/6	—	11 18 0
Revo (10/–)	36/3	30/–	12	17½	33/9	—	5 3 8
Reyrolle	62/6	49/–	12½	12½	57/3	—	4 6-10
Siemens Ord.	31/–	20/6	7½	7½	23/3	—6d.	6 10 4
Strand Elec. (5/–)	6/–	4/–	5	10	5/0	—	10 0 0
S. Smith (1/–)	9/9	6/3	37½	50	8/9	—	5 14 3
Switchgear & Cowan (5/–)	19/6	12/6	20	20	13/9	—	7 5 6
Telegraph Condenser (10/–)	18/9	12/–	5	5	7/6	—	6 13 4
Telegraph Construction	2½	36/–	7½	10	37/6	—	5 6 8
Telephone Mfg. (5/–)	9/9	7/–	9	9	9/–	—	5 0 0
Tube Investments	89/6	70/–	23¾	23¾	87/6	+6d.	5 10 0
Vactric (5/–)	9/9	4/6	10	4	3/9	—	5 6 8
Vickers (10/–)	27/–	17/6	10	10	21/–	—	4 15 3
Westinghouse Brake	63/9	45/–	17½	17½	50/–	—	7 0 0
Walsall Conduits (4/–)	26/–	22/6	—	55	27/6	—	7 17 0
West, Allen (5/–)	6/6	4/6	7½	10	6/9	—	7 8 2

* Dividends are paid free of Income Tax.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1937

14442. "Electron focusing systems." Marconi's Wireless Telegraph Co., Ltd. (Radio Corporation of America). May 24th, 1937. (501437.)

15124. "Thermionic valves." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd., May 31st, 1937. (Cognate application 15599/37.) (501515.)

17661. "Electric pilot devices for navigational purposes." G. Santucci. June 24th, 1936. (501439.)

18263. "Automatic cut-outs for electrically heated utensils and appliances." Premier Electric Heaters, Ltd., and A. E. Newton. July 1st, 1937. (501583.)

20333. "Electrical musical instruments." J. Compton Organ Co., Ltd., and L. E. A. Bourn. July 22nd, 1937. (501733.)

20428. "Method and means for electrically warming and airing beds." G. P. Taylor. July 23rd, 1937. (501444.)

20670. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd. July 25th, 1936. (501446.)

20738. "Electric oscillation generators." Telefunken Ges. für Drahtlose Telegraphie. July 27th, 1936. (501448.)

21163. "Radio receivers." Marconi's Wireless Telegraph Co., Ltd. (Radio Corporation of America). July 30th, 1937. (501644.)

21275. "Wall-boxes and junction-boxes for use in connection with electrical wiring conduits." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. July 31st, 1937. (501519.)

21310. "Electrical production of musical tones." A. H. Midgley and A. M. Midgley. July 31st, 1937. (501520.)

22901 "Electric converting circuits." British Thomson - Houston Co., Ltd. August 20th, 1936. (501735.)

23286. "Electro-optical systems for recording sounds and like oscillatory systems." Western Electric Co., Ltd. (Electrical Research Products, Inc.). August 25th, 1937. (501587.)

23514. "Electric cables." D. A. O'Duffy. August 27th, 1937. (501593.)

23536. "Television transmitter." C. Lorenz Akt.-Ges. August 29th, 1936. (501802.)

23600. "Lubricating means for the rollers of trolley arms of electric tramways." N. Kipouropoulos. August 28th, 1936. (501594.)

23673. "Method of and means for controlling the operation of electron multiplying tubes." Vereinigte Glühlampen und Elektrizitäts Akt.-Ges. August 28th, 1936. (501740.)

23675. "Luminescent materials." Marconi's Wireless Telegraph Co., Ltd. August 29th, 1936. (501741.)

23679. "Superheterodyne receivers." Standard Telephones & Cables, Ltd., R. M. Barnard and W. Kram. August 30th, 1937. (501529.)

23737. "Television receivers." Telefunken Ges. für Drahtlose Telegraphie. August 29th, 1936. (501532.)

23787. "Television and like systems." Baird Television, Ltd., and T. C. Nuttall. August 31st, 1937. (501535.)

23914. "Electric welding machines of the spot type." Soudure Electrique. September 5th, 1936. (501546.)

23916. "Trunk communication cables for multiple carrier frequency systems." Siemens & Halske Akt.-Ges. August 25th, 1937. (501660.)

24093. "Dynamo regulators." J. Lucas, Ltd., and J. A. Laird. September 3rd, 1937. (501811.)

24120. "Television and like receivers." Baird Television, Ltd., and L. R. Merdler. September 3rd, 1937. (501753.)

24149. "Magnetically operated electric switches." A. Cianchi. September 3rd, 1937. (501756.)

24150. "Magnetically operated electric switches." A. Cianchi. September 3rd, 1937. (501815.)

24155. "Cathode - ray apparatus." F. J. G. Van Den Bosch. September 3rd, 1937. (501816.)

24159. "Arc-welding apparatus with coated electrodes." Kjellberg Elektroden & Maschinen Ges. September 3rd, 1936. (501757.)

24228. "Navigation-aiding directional radio receiving systems." Marconi's Wireless Telegraph Co., Ltd., and T. A. Vallette. September 4th, 1937. (501550.)

24229. "Radio and like receivers." Marconi's Wireless Telegraph Co., Ltd., O. E. Keall and N. M. Rust. September 4th, 1937. (501760.)

24242. "Timing switches and mechanism." Eagle Signal Corporation. September 14th, 1936. (501665.)

24291. "Apparatus for the manufacture of scanning discs for television apparatus." Radioakt.-Ges. D. S. Loewe. September 9th, 1936. (501608.)

24455. "Plug sockets for electric connectors and switches." A. Watson. September 8th, 1937. (501609.)

25754. "Thermally operated automatic switch." Stotz-Contakt.-Ges. September 22nd, 1936. (501612.)

26159. "Automatic telephone systems." Telefonaktiebolaget L. M. Ericsson. September 28th, 1936. (501551.)

26441. "Electric switch control means, particularly for use with weighing mechanisms." W. & T. Avery, Ltd., and A. Binns. September 30th, 1937. (501614.)

27496. "Electrical precipitation of suspended particles from gases." Whessoe Foundry & Engineering Co., Ltd., A. G. Grant, and A. Puttick. October 9th, 1937. (501616.)

29441. "Electric welding apparatus." Linde Air Products Co. February 6th, 1937. (501619.)

29852. "Multi-way electric switches for use in radio and like circuits." Plessey Co., Ltd., and F. G. Gillard. November 1st, 1937. (501556.)

30251. "Electrically heated irons." General Electric Co., Ltd., and J. L. Rycroft. November 4th, 1937. (501676.)

30613. "Control of electrically driven reciprocating machines." British Thomson-Houston Co., Ltd. November 10th, 1936. (501621.)

32694. "Manufacture of luminescent screens." General Electric Co., Ltd., H. G. Jenkins and A. H. McKeag. November 26th, 1937. (501624.)

35963. "Electric heaters for the windscreens of motor vehicles." C. R. Hopkins. December 29th, 1937. (501683.)

1938

324. "Fusible elements for the protection of electric circuits." Callender's Cable & Construction Co., Ltd., and A. W. Metcalf. January 5th, 1938. (Cognate application 21001/38.) (501684.)

512. "Electrical musical instruments." H. Selmer & Co., Ltd., and B. Davis. January 7th, 1938. (501685.)

1408. "Thermostatic control switches." British Thomson - Houston Co., Ltd. January 15th, 1937. (501686.)

3035. "Electro-magnetic induction apparatus and the manufacture of the same." British Thomson-Houston Co., Ltd. January 30th, 1937. (501474.)

4405. "Piezo-electric apparatus for repeating electric impulses." Standard Telephones & Cables, Ltd. March 16th, 1937. (501691.)

4558. "Radio receiving apparatus." W. J. Brown. February 14th, 1938. (501692.)

8415. "Telephone handset with combined transmitter and dial." Standard Telephones & Cables, Ltd. April 28th, 1937. (501696.)

9147. "Electric heating elements for high-temperature furnaces." Naamlooze Vennootschap-Molybdenum Co. July 22nd, 1937. (Cognate applications, 9148/38 and 9149/38.) (501698.)

11550. "Electron-discharge devices with successive electrically controlled multiple - emissions." Standard Telephones & Cables, Ltd. May 5th, 1937. (501701.)

11613. "Selector mechanism for use in telegraphic printers." C. Olivetti & Cia Soc. Anon. April 27th, 1937. (Cognate application 11614/38.) (501702.)

14042. "Manufacture of electric-discharge tubes containing fluorescent screens." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 14th, 1937. (501490.)

14979. "Telegraph-exchange system." C. Lorenz Akt.-Ges. May 19th, 1937. (501705.)

17017. "Magnet structure." W. W. Groves (Cinaudograph Corporation). June 8th, 1938. (501708.)

18284. "Electric lamps and methods of manufacturing the same." British Thomson-Houston Co., Ltd. June 21st, 1937. (501712.)

22020. "Ward-Leonard control system, especially applicable to electric motors for driving elevating and/or traversing gear of gun turrets." Rheinmetall-Borsig Akt.-Ges. and A. Geitmann. July 25th, 1938. (501716.)

22843. "Telegraph apparatus." Creed & Co., Ltd., A. E. Thompson and R. D. Salmon. August 27th, 1937. (Divided out of 490361.) (501717.)

23077. "Electric-discharge tube comprising a fluorescent screen." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 7th, 1937. (Addition to 441813.) (501718.)

25028. "Methods of illumination and electric-discharge lamps therefor." British Thomson-Houston Co., Ltd. August 25th, 1937. (501794.)

26700. "Welding electrodes." British Thomson-Houston Co., Ltd. September 13th, 1937. (501721.)

31702. "Portable electric torches." Chloride Electrical Storage Co., Ltd. November 12th, 1937. (501725.)

32596. "Apparatus for electrically testing the thickness of thin layers." W. H. Tait. August 30th, 1937. (Divided out of 23600/37.) (501634.)

32867. "Electron multipliers." Standard Telephones & Cables, Ltd. October 24th, 1936. (Divided out of 26623/37.) (501726.)

1939

3329. "Wall-boxes and junction boxes for use in connection with electrical wiring conduits." J. A. Crabtree & Co., Ltd., H. F. McLoughlin and B. G. Harrison. July 31st, 1937. (Divided out of 501519.) (501728.)

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 22nd :—

Super Silicon (lettering and design). No. 601241. Class 6 (IV). Welding metal in rods.—Suffolk Iron Foundry (1920), Ltd., Gipping Works, Stowmarket, Suffolk.

Neco (lettering and design). No. 600715. Class 11 (IV). Electric cooking stoves, water-heating apparatus and refrigerators, electric lamps (not for surgical or curative purposes, electric lighting installations, motor car heating apparatus and ventilators.—The Normand Electrical Co., Ltd., Neco Works, North Street, Clapham Common, S.W.4.

Amplume. No. 604042. Class 11 (IV). Lamp reflectors.—The Co-operative Wholesale Society, Ltd., 1, Balloon Street, Manchester.

Dayfecto. No. 604569. Class 11 (IV). Lighting apparatus and fittings made of glass and lighting reflectors made of common metal or of glass and common metal.—Harcourts, Ltd., 223, Moseley Street, Birmingham.

Belgian Output Declines

According to the Belgian journal, *Eclairage et Force Motrice*, the monthly average output of electric power in Belgium during last year amounted to about 439 million kWh, as compared with 462 million kWh in 1937, a decrease of 5 per cent. There was also a decline in the gas output.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Australia.—VICTORIA.—June 27th. State Electricity Commission. 4,000-kW house sets at the Newport "C" power station. (March 17th.)

BRISBANE.—April 21st. Electricity Supply Department. 11,000-V metal-clad switchboards. (T.Y. 20076/39.)*

MELBOURNE.—May 16th. Magnetic submarine telephone cable. (T. 20360/39.)*

TASMANIA.—June 12th. Electricity Department. Terminal station switchboard, one motor-generator set, auto-transformers and high- and low-voltage underground cables. (T. 20437/39.)*

Birkenhead.—April 18th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Birmingham.—April 14th. Electric Supply Department. One seven-panel, 11,000-V, extra-high-voltage metal-clad switchboard. (March 24th.)

Brecknockshire.—April 13th. Standing Joint Committee. Installation of electric lighting in Defynock police station. H. Strickland, county architect.

April 12th. Electric lighting and power installation at Brecon Isolation Hospital County architect, County Offices, Brecon.

Bromley.—April 14th. Electricity Department. Single- and three-phase static transformers. (March 24th.)

Chester.—April 11th. City Council. Electric wiring installation at Blacon school. (March 24th.)

Dagenham.—April 5th. Borough Council. Electrical installation at swimming pool, concert hall, and dressing-rooms. (March 24th.)

Dundee.—April 6th. Electricity Department. AC house service meters for twelve months. (March 17th.)

Egypt.—CAIRO.—May 1st. Ministry of Public Works. Complete electrically driven pumping station at Edfu North. (T.Y. 19778/39.)*

Glasgow.—April 11th. Transport Department. Materials for a year, including v.i.r. cable, electrodes, &c. Town Clerk.

Halifax.—April 3rd. Libraries and Museums Committee. Electrical work at the branch library, Pellon. Town Clerk, Town Hall (deposit £1 1s.).

April 3rd. Housing Committee. Electrical work at Charlestown housing estate (thirty-six houses and thirty-six flats). Town Clerk, Town Hall (deposit £2 2s.).

April 8th. Health Committee. Electrical work at new hospital operating theatre block. Town Clerk, Town Hall (deposit £1 1s.).

April 10th. Improvement Committee. One electric passenger lift. Town Clerk, Town Hall (deposit £1 1s.).

Manchester.—April 5th. Electricity Committee. Diffusing glass shades, electric kettles, meters and AC motors for twelve months. (See this issue.)

Mexborough.—April 7th. Electricity Department. Extra high- and low-voltage cables for twelve months. (March 24th.)

Morocco.—RABAT.—April 21st. Protectorate Post Office Authorities. Quantities of lead-covered telephone cables. (T. 20250/39.)*

Newcastle-on-Tyne.—April 24th. Tyne Improvement Commission. Eight 3/1½-ton and two 5/2½-ton electric travelling portal level luffing cranes, or alternatively, ten 3/1½-ton cranes, for the New Quay, North-West Corner, Tyne Dock. The chairman, Tyne Improvement Commission, Bewick Street (deposit £3 3s.).

Newark-on-Trent.—April 17th. Electricity Department. One 500-kVA outdoor type transformer, complete with on load tap changing equipment. (See this issue.)

Newcastle-under-Lyme. — May 12th. Highways Committee. Seventy-three street lighting lamps, lanterns, fittings and columns. (See this issue.)

Portsmouth.—April 4th. Electricity Undertaking. One 5,000-kVA transformer at the generating station, Gunwharf Road. (March 17th.)

April 14th. One 15,000-kVA transformer at the generating station, Gunwharf Road. (See this issue.)

Electricity Undertaking. April 14th. 1,500 cooker control units and 2,000 switch fuses. (See this issue.)

Rochdale.—April 4th. Eleven electrically operated steel roller shutters at the generating station. F. H. Rudd, engineer and manager, Corporation Electric House, Smith Street.

Scarborough.—April 8th. Electrically driven pumping machinery. T. E. Deamer, engineer and surveyor, U.D.C. Offices, Scalby (deposit £3 3s.).

Sheffield.—April 3rd. Electricity Department. Complete automatic telephone system for the electricity undertaking. (March 17th.)

Southport.—April 17th. Town Council. Two lifts. (See this issue.)

South Africa. — JOHANNESBURG.—April 15th. City Council. Two exhaust fans, complete with all associated equipment. (T. 20207/39.)*

April 12th. Extra-high-voltage cable end boxes. (T. 20213/39.)*

April 15th. One glass bulb mercury-arc rectifier unit complete with main transformer and all associated gear. (T. 20212/39.)*

April 24th. Railways and Harbours Administration. Seven motor alternator sets. (T. 19896/39.)*

April 26th. Two petrol-electric mobile cranes for Port Elizabeth Harbour. (T. 19894/39.)*

April 26th. One two-ton electrically driven portal jib crane for Port Elizabeth Harbour. (T. 19893/39.)*

PAULPIETERSBURG. — May 1st. Town Board. Hydro-electric power plant, including water turbines, generators, switchgear and high-voltage line. (T. 20216/39.)*

Southern Rhodesia.—SALISBURY.—April 26th. Municipality. Steam accumulator installation and associated auxiliary equipment. (T. 20037/39.)*

April 26th. Two 5,000-kW turbo-alternators, condensing plants and associated auxiliary equipment, including water pumps, spray gear, main switchgear, transformer, &c. (T. 19887/39.)*

Stanley.—April 7th. Electricity Department. Cables, meters, lamps and wiring supplies. (March 24th.)

Stockport.—April 3rd. Electricity Department. Meters, cut-outs, joint boxes, disconnecting boxes and disconnecting pillars for twelve months. (March 17th.)

Stockton-on-Tees.—Town Council. Electric lighting and power installation at maternity home at Newham Grange. Plans by A. S. Knolles, borough engineer, Victoria Buildings.

Tottenham.—April 25th. Transport and Cleansing Department. Magnetic separator. (See this issue.)

Wallsend.—Town Council. Lighting fittings and electrical installations at a new maternity and child welfare centre. Plans by J. A. Blench, borough engineer, Town Hall.

Walton and Weybridge.—April 3rd. U.D.C. Erection of the electrical equipment of a new sub-station at Hersham and high-voltage feeder cable. (March 17th.)

Warrington.—April 17th. Electricity and Transport Committee. Transformers. (See this issue.)

Weymouth.—April 4th. Electricity Department. Cable for twelve months and extra-high-voltage switchgear and transformers. (March 17th.)

Whitley Bay.—U.D.C. Electric lighting installations in ninety-two houses on the Hartley and Murton housing estates. Plans by A. J. Rousell, surveyor, Council Offices.

Orders Placed

Bexhill.—Electricity Committee. Recommended. Switchgear (£1,347).—A. Reyrolle & Co.

Recommended for twelve months: House-service joint boxes.—Callender's. House-service cut-outs.—W. Lucy & Co. Feeder pillars.—Siemens Bros. Cables.—Telegraph Construction & Maintenance Co. Ordinary meters.—Sangamo Weston. Prepayment meters.—Met.-Vick.

Brighton.—Waterworks Committee. Recommended. Two electrically driven booster pumps, motors, control gear, &c. (£975).—F. Pearn & Co.

Corporation. Accepted. One electrically driven boiler-feed pump, complete with motor (£822) and one hydro-jet pump, complete with motor (£546).—Mather & Platt. One 5,000-kVA transformer (£1,880).—Ferranti. 250-V and 660-V cables (£396).—Wm. Geipel.

Eastbourne.—Electricity Department. Accepted. P.i. cables.—Britannic Electric Cable & Construction Co.; Scottish Cables. Small v.i.r. cables.—General Cable Manufacturing Co. Low-voltage joint boxes.—Callender's Cable & Construction Co. Transformers.—British Electric Transformer Co. Cut-outs and fuses.—W. Lucy & Co. Street lamp standards.—Revo Electric Co.; Bromford Tube Co.; Simplex Electric Co.; Electric Street Lighting Apparatus Co. Switchgear.—Ferguson, Pailin. Quarterly meters.—Switchgear & Meters. Filament lamps.—Splendor Lamp Co.; Luxram Electric; L. Andrew & Co.; Commercial Electric Co.; Tungstalite. Discharge lamps, leak transformers, chokes and condensers.—L. G. Ford. Small cookers.—Jackson Electric Stove Co. Medium cookers.—G.E.C. Water heaters.—Aidas Electric.

Falkirk.—Corporation. Accepted. Two 750-kVA transformers (£750).—Bonar, Long & Co. 500-yd. of cable (£129).—Britannic Elec. Cable & Construction Co.

Hull. — Electricity Committee. Accepted for twelve months. Transformers.—Met.-Vick. Elecl. Co.; Yorkshire Electric Transformer Co. Lamp posts.—Revo Electric Co. Lamp brackets.—Wardle Engineering Co. Time switches.—Horstmann Gear Co. Wash boilers.—Burco. Cooker terminal boards.—T. Beadle & Co. Water heaters.—Berry's Electric. Kettles.—T. Beadle & Co. Immersion heaters.—Hotpoint; G.E.C.

Kettering. — Electricity Department. Accepted for twelve months. Extra-high and low-voltage cables.—Union Cable Co. Single-phase, 230-V meters.—Sangamo-Weston; English Electric Co. Prepayment meters.—Venner Time Switches. One 350-kVA and one 400-kVA transformer.—B.T.H. Co.

London.—HAMMERSMITH.—Electricity Committee. Recommended for twelve months. Insulated wires.—Edison Swan. Meters and meter scales.—Aron. M.d. indicators.—P. & B. Engineering Co. Cables.—Henley's; Pirelli-General. Frames and covers.—Elenley's; Dover Engineering Works. House service cut-outs.—Siemens Electric Lamps & Supplies; W. Lucy & Co. Disconnecting boxes.—Henley's. Electrical accessories: Switches.—Wholesale Fittings Co. Switch-fuses.—Hornby Electrical Supplies Co. Lampholders.—Wm. Maxwell & Co. Shades.—Simpson, Baker & Co. Torch batteries.—London Electrical Co. Conduit and flexible tubing.—Lamberts. Fuse wire and insulating tapes.—G.E.C. Cooker control switches.—Z. Electric Lamp & Supplies Co. Cut-outs.—Foster Engineering Co.

BATTERSEA.—Works Committee. Electricity Committee. Recommended. Electrical fittings for showrooms (£242).—Benjamin.

Recommended for twelve months: Electricity meters.—Chamberlain & Hookham; Ferranti. Joint boxes and house service cut-outs.—Callender's. Disconnecting boxes.—Henley's. Joint box compound.—Dussek Bitumen and

Taroleum. Electrical wires for installation work.—Stearn Electric Co. Copper wire.—Armorduct Cable Co. Flexible wires and wiring accessories.—Wm. White & Co. Conduit and conduit fittings.—Mosers. Switches and cooker control units.—J. A. Crabtree & Co. Insulating tape.—Henley's. Iron-clad cut-outs and switch fuses and iron-clad splitters. — Foster Engineering Co. Cookers (small size).—Jackson Electric Stove Co. "Cookerettes."—Belling & Co. Water heaters.—Heatrae. Immersion heaters.—Santon. Wash boilers.—Alder Electrical Appliances. Kettles.—Bulpitt & Sons. Switchplugs.—C. H. Parsons.

STEPNEY.—Finance and Parliamentary Committee. Recommended for twelve months: Lead-covered, p.i., armoured and unarmoured cables (£8,448).—Standard Telephones & Cables. Electric cookers (£12,800) and irons (£343).—Revo Electric Co. Kettles (£1,901).—G.E.C. Wiring materials (£256).—Wilec, Ltd. House-service cut-outs and sealing chambers (£517). — Henley's. Change-over from DC to AC: Premises of Godfrey Phillips, Ltd. (£6,027).—Met.-Vick. Elecl. Co. Cooke's (Finsbury), Ltd., Ely Terrace (£201).—City Elecl. Co. Stepney Laundry. Ltd. (£5.679).—J. G. Sneath. Messrs. Potter & Clarke, M. Barnett & Son, G. Newton, Ltd., and H. Parker (£837).—City Electrical Co. Various consumers' premises (£711) and ninety-six AC motors and control equipment (£251).—G.E.C.

Morley. — Town Council. Accepted. Cables.—W. T. Glover & Co.; T. B. Morley & Co.

Shipley.—Electricity Committee. Accepted. Five 750-kVA transformers (£600 each).—Hackbridge Elec. Constn. Co.

Stoke-on-Trent.—Electricity Committee Accepted. Transformers (£5,286).—Met.-Vick. Electl. Co.

Wallasey.—Electricity Committee. Accepted. Switchgear (£1,513).—Met.-Vick. Electl. Co.

Wimbledon. — Electricity Committee. Accepted. Switchgear units (£2,553).—Drake & Gorham.

Whitby.—U.D.C. Accepted. Switchgear.—Crompton Parkinson & Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Extension to factory, Brunel Road; Hillier, Parker, May & Rowden, 27, Maddox Street, W.1.

Altrincham.—Reconstruction and extension of Stamford Hall (£10,000); Jame Bowers, contractors, Stockport Road, Timperley.

Arbroath.—Cinema (£25,000); J. B. Milne, cinema proprietor, Dundee.

Ashington.—R.C. school; F. A. Coyle, architect, 11, Saville Row, Newcastle-on-Tyne.

Atherton.—Houses (30), Hag Fold estate; U.D.C. surveyor.

Bacup.—Houses (52), Thorn estate; H. Guffogg, borough engineer, Municipal Offices.

Barkingside.—School, Dr. Barnardo's Homes (£26,000); W. H. Godfrey, architect, Lewes House, Lewes.

Batley.—Two-storey block, Commercial Street, for Montague Burton, Ltd., Hudson Road, Woollen Mills, Leeds, 9; W. & A. Forsdike, Ltd., contractors, St. Mary's Road, Sheffield, 2.

Buckinghamshire. — School, Walton Grange (£26,290), for the County E.C.

Cambridge.—Factory, Cherry Hinton; Lamson Paragon Supply Co., Ltd., Canning Town, London, E.16.

Carlisle.—Houses (350), for the City Council; city engineer, 18, Fisher Street.

Cheltenham. — Buildings (£70,000), Fullwood Park, for St. Mary's College; T. Overbury, college architect.

Coatbridge.—Houses (64), Espieside, for T.C.; burgh surveyor.

Coventry.—Art school, Butts Recreation Ground, for the E.C.; D. E. E. Gibson, architect, The Council House.

Crewe.—Houses (300), Copper Hill estate; Sparke & Stephens, Ltd., building contractors, Stockport Road, Timperley, Altrincham.

Croydon.—Rebuilding premises, South End (£20,000), for Provident Clothing & Supply Co., Ltd.; G. T. Harman, architect, 90a, High Street, Lewisham, S.E.13.

Docking.—Houses (74), for R.D.C.; J. H. Marshall, clerk, Council Offices, Station Road.

Durham County.—Bearpark Council school, for E.C.; F. Willey, county architect, 34, Old Elvet.

Easington.—Houses (42), Haswell Moor; Durham Aged Mineworkers' Homes Association.

Easton (YORKSHIRE).—Reconstruction of Princess Street Council school; J. R. White, County Hall, Northallerton.

Exeter.—Reconstruction of Theatre Royal, new North Street; Exeter Theatre Co., Ltd.

Gateshead.—Houses (66), Old Ford estate; borough engineer. Houses (136), Sheriff Hill area, for the North-Eastern Housing Association, Metrovick House, Northumberland Road, Newcastle-on-Tyne. Extensions to factory, Exean Products, Ltd., Team Valley Trading estate; J. W. Hanson and Son, architects, Eldon Place, Newcastle-on-Tyne.

Hanford (STAFFORDSHIRE).—Houses (20), New Inn Lane; E. Pierce.

Harrow.—Masonic hall and restaurant, Headstone Lane; H. J. Marks, architect, 63, Masons Avenue, Wealdstone.

Hebburn-on-Tyne. — Extensions to Hebburn Hall Infirmary (£12,000); P. L. Browne, Son and Harding, architects, Pearl Buildings, Newcastle-on-Tyne.

Humshaugh (NORTHUMBERLAND).—C. of E. school (£13,000); Mauchlen and Weightman, architects, 12, Saville Row, Newcastle-on-Tyne.

Ipswich.—Extensions to isolation hospital; borough engineer.

Jarrow-on-Tyne.—Houses, York Avenue; J. Campbell, Grant Street. Steelworks for Jarrow Steel Co.; International Construction Co., Ltd., general contractors, Kingsway, London, W.C.2.

Keighley.—Houses (34), Moor View Grove; D. O'Connell.

Kettering.—Houses (50), Corby, Northampton; Gotch, Saunders & Surridge, architects, Bank Chambers, Kettering.

Kirkcudbrightshire.—Houses (223), in various parts of county, for C.C.; A. T. Caldwell, county architect, Kirkcudbright.

Lancashire.—School, Turton (£38,334), for E.C.; county architect, Preston. Extensions to Audenshaw Grammar school, for County E.C.; C. H. Godfrey & Sons, contractors, Bowling Road, Gorton, Manchester, 16. Extensions to Burtonwood Council school, near Warrington, for the County E.C.; P. Conlon, contractor, 84, Seymour Grove, Old Trafford, Manchester 16.

Lewes.—Houses (80) and shops, Landport estate; borough engineer.

London.—(CHISWICK).—Extensions to factory, Bush Radio, Ltd., Power Road. (GREENWICH). — Tenements. Coldbath Street; borough engineer. (SYDENHAM).—Cinema, Southend Lane; T. Spencer Bright & Co., 1, New Court, W.C.2. (WILLESDEN).—Large extensions to factory, Victoria Road, for Elliott & Co., Ltd.; M. S. Blanchfield, architect, 76-78, Commercial Road, E.1.

Longbenton. — Houses (106), Dudley, for the U.D.C.; R. Carse and Son, builders, Morpeth.

Lytham St. Anne's.—Houses (56), Shepherd Road; P. S. Uttley, builder, Leach Lane, St. Anne's-on-Sea.

Macclesfield. — Houses (45), London Road; borough engineer.

Mansfield. — Houses (24), Debdale Lane; R. R. Sorrell, Debdale Lane.

Middlesbrough. — Houses (28), Lydbrook Road; J. Gilmore, builder, 179, West Lane. Houses (159), St. Mary's Walk; Dean Brothers, builders, Marton Road, Middlesbrough. Factory, Longlands Road, for the Regent Ice Cream Co., Ltd.; Kitching and Co., architects, 21, Albert Road.

Monkseaton. — R.C. senior school (£20,000); R. Burke, architect, Singleton House, Northumberland Road, Newcastle-on-Tyne.

Morpeth. — Omnibus station, Bridge Street; United Automobile Services, Ltd., Darlington.

Murton Colliery (Co. DURHAM).—Miners' hall (£9,000); J. W. Hays, architect, Central Chambers, Wingate, Durham.

Newcastle-on-Tyne.—Houses in flats (48), for N. and W. Cooknell, Blyth; J. N. Fatkin, architect, 17, Bigg Market. Lecture theatre and extensions to pathological block, Queen Victoria Road; Newcombe and Newcombe, architects, Eldon Square. Shops and showrooms, Northumberland Street, for Messrs. Phillips; Donaldson and Partners, architects, 17, St. Anne's Square, Manchester.

Newcastle (STAFFORDSHIRE).—Houses (48), Heaton Terrace, Clare Avenue, Wolstanton; D. G. H. Walley.

Northern Ireland (BELFAST).—Factory, Donegall Street, for Atkinson & Co.; McLaughlin & Harvey, Ltd., builders, Belfast.

Plympton.—Development of 300-acre estate, Chaddleswood, for Plympton Properties, Ltd.; F. W. Beech, architect, 16, Southernhay West, Exeter.

Pontesbury (SHROPSHIRE). — School; Robert Hening and Anthony M. Chitty, architects, 6, Cavendish Square, London, W.1.

Portishead.—Council offices; U.D.C. surveyor.

Rawtenstall.—Extensions to King's Cinema, Booth Street; Bacup & Rossendale Land Co., Ltd.

Rugby.—Houses (76), Reservoir Road, &c.; Davis Estates, Ltd., Westfield estate.

St. Paul's Cray.—Factory, Sevenoaks Way, for The Telephone Manufacturing Co., Ltd.

Sale (CHESHIRE).—Houses (50); W. A. Costello, Woodcroft, Ashton Lane.

Smethwick.—Extensions to factory, Oldbury Road; Alberta Manufacturing Co., Ltd.

Staffordshire.—School, Pleasey estate, Great Barr, Birmingham, 22, for C.C.; F. A. Hughes, director of education, County Education Offices, Stafford.

Stanley (Co. DURHAM).—Houses (200), for the U.D.C.; A. Routledge, U.D.C. surveyor.

Stirling.—School, corner of Drip Road and Raploch Road, for C.C.; A. N. Malcolm, architect.

Stoke-on-Trent.—Houses (51), Eastern Avenue, Sneyd Green; C. W. Critchley.

Suffolk.—Additions and alterations to Sudbury Grammar school, for E.C.; county architect, 13, Westgate Street, Bury St. Edmunds.

Sunderland.—Remodelling and extension of Monkwearmouth Central schools, for T.C.; O. Hall Mark, architect, 4, Tatham Street.

Swadlincote.—Houses (120), Newhall estate; R. Hustwayte.

Tenterden (KENT).—Houses (24), for R.D.C.; H. Parks, R.D.C. surveyor.

Thingoe.—Houses (34), Great Whelnetham and Bradfield St. George, for R.D.C.; A. F. Chamberlayne, clerk.

Thornaby-on-Tees.—Houses (60), for the T.C.; Lawson and Boddy, builders, Darlington.

Truro.—Large omnibus station; Western National Omnibus Co.

Turton (LANCASHIRE).—Houses (52), Crescent Road estate, Eagley; R. Dart, U.D.C. surveyor.

Tynemouth.—Conversion of premises, Northumberland Square, into offices, for T. Archer Lee, Ltd.; G. H. Gray, architect, 56, Camden Street, North Shields.

Upper Norwood (CROYDON).—Houses (24); Wates, Ltd., London Road, Norbury.

Walsall.—Houses (180), near Darlaston Road and Gower Street, Pleck; M. E. Habershon, borough surveyor.

Westerham.—Cinema; A. P. Starkey, architect, Station Road, Harrow-on-the-Hill.

Westmorland. — Rebuilding of the Westmorland Gazette Offices, Stricklandgate, for Westmorland Gazette, Ltd.; A. Benson, contractors, Maude Street, Kendal.

West Penwith.—Houses (34), Marazion and St. Erth, for R.D.C.; K. A. Rose, architect, 11, Morrab Road, Penzance.

Weymouth.—Extensions to factory, for Whitehead Torpedo Co., Ltd., Wyke Regis.

Whitley Bay (NORTHUMBERLAND).—Council offices (12,000); Cordingley and McIntyre, architects, The College, Durham City.

Worksop.—Houses (31), Thievesdale Lane; F. Haslam, building contractors, Hall Cross, Doncaster.

York.—Houses (40), Penyghent Road and Whernside Avenue; H. Williamson, Heworth Green.

Yorkshire.—Schools, Hebden Royd and Queensbury (£103,000), for the West Riding E.C.